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BILINGUALISM AND COGNITIVE REPRESENTATION

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "BILINGUALISM AND COGNITIVE REPRESENTATION" submitted by JAMES PATRICK CUMMINS in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

M. Gulutsan
Supervisor

B. G. Bain

Douglas V. Parker

for G. R. Tucker
External Examiner

Date April 26 1974

ABSTRACT

This study is concerned with the consequences of becoming bilingual both for the bilingual's level of operational intelligence and for his ability to express his intelligence through verbal and imagistic symbols. This issue is examined by means of both a theoretical analysis and an empirical investigation.

The theoretical analysis of the present study is based on Piaget's theory of cognition which states that the development of operational thought cannot be explained by the influence of language. This viewpoint is contrasted with Vygotsky's theory which emphasizes that logical thought is made possible through the internalization of speech. The implications of both these positions for the study of the relationships between bilingualism and cognition are drawn out. It is shown that both Piaget's and Vygotsky's theories on the role of language in intellectual growth are equally compatible with the results of recent empirical studies in which bilinguals performed at a significantly higher level than unilinguals on various measures of cognitive performance.

In a number of previous studies it has been assumed that bilingualism is likely to affect cognition only to the extent that language itself is involved in the thinking process. This theoretical rationale is challenged in the present study on the basis that non-linguistic features of the bilingual learning situation may account for the effects of bilingualism on cognitive development.

In the empirical study sixty one balanced bilinguals from the sixth grade of the French-English bilingual program in Edmonton, Canada, and sixty one unilinguals were matched on the basis of sex, socio-economic status and age and compared on a battery of memory, reasoning and divergent thinking tasks which required both verbal and imagistic processing.

The bilingual group performed at a significantly higher level on the verbal ability and general reasoning tests and also on a measure of verbal originality. These results, together with other recent research studies support the position that bilingualism facilitates verbal information processing.

The balanced bilinguals (N=61) were also compared with students in the bilingual program who did not meet the criterion of linguistic balance (N=21). The balanced group performed at a significantly higher level on the general reasoning test and on all three measures of verbal divergence.

Differences both in linguistic balance and verbal ability were found between children in the bilingual program who came from three different linguistic home backgrounds - English, French and mixed French-English. These differences are discussed in relation to the planning of curricula for bilingual education programs.

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CHAPTER 1

INTRODUCTION

Introduction to the Problem

Bilingualism has been with us since the beginnings of human history and is a problem which affects the majority of the world's population. In spite of this, however, it was not until the early 20th century that the first systematic studies were carried out on the effects of bilingualism on the personality traits and intellectual abilities of individuals. This neglect was due to the fact that related issues such as the relationship between language and thought were long considered the domain of philosophical speculation.

The introduction of standardized testing procedures in the early 1920's presented investigators with what appeared to be a straightforward means of discovering how bilingualism affected the individual's personality traits and intellectual abilities. This early research gave rise to many contradictory assertions about the influence of bilingualism. These have been summed up by Mackey (1967) as follows:

> "It has been claimed that bilingual children lack confidence, have a low level of maturity, ... and have feelings of confusion. . .It is claimed that bilingual children. . .have difficulty in abstract reasoning, and. . the bilingual person is either devoid of cultural roots or belongs to a hybrid culture. . .On the other hand, it has been claimed that at least some forms of bilingualism are not a handicap, . . .and that there is no evidence to show that the alleged handicaps were caused by bilingualism as such (1967, p. 50-51)."

In North America the widespread belief that bilingualism has negative intellectual and emotional consequences went hand in hand with a "melting pot" philosophy which exerted pressure on immigrant groups to abandon their former language and culture. One consequence of this, as Andersson (1971) points out, is that bilingual schooling - in the sense of instruction in and through two languages - disappeared from the United States scene between 1920 and 1963. Tucker and d'Anglejan (1971) outline four widely-held beliefs regarding bilingual education. These are:

> (1) Children who are instructed bilingually from an early age will suffer cognitive or intellectual retardation in comparison with their monolingually instructed counterparts.
>
> (2) They will not achieve the same level of content mastery as their monolingually instructed counterparts.
>
> (3) They will not acquire acceptable native language or target language skills.
>
> (4) The majority will become anomic individuals without affiliation to either ethnolinguistic contact group.

Tucker and d'Anglejan (1971) point out that the research which has taken place since the early 1960's suggests that these beliefs are "myths" and that bilingualism and bilingual education need have no such negative consequences.

The reversal in the results of research into the effects of bilingualism can be attributed to the fact that many of the early psychometric studies of bilingualism and I.Q. were badly designed. Among other things, they did not control for factors such as socio-economic status (SES) or the bilingual's knowledge of his two languages. Most of the studies since Peal and Lambert's (1962) study have controlled for these factors and have tended to show that bilingualism has positive consequences both for the attitudes and intellectual abilities of the individual.

Statement of the Problem

The question investigated in the present study was related to the first "myth" listed by Tucker and d'Anglejan i.e. the belief that bilingualism and bilingual education have negative consequences for the cognitive abilities of children. The specific problem was to determine what effects the bilingual's access to and use of two languages has not only on his powers of general reasoning but also on his ability to express his intelligence through verbal and imagistic symbols. In other words, the effects of bilingualism on two distinct levels of cognition were examined; on the one hand, general reasoning, or in Piagetian terms operational intelligence, on the other, the symbolic systems through which this intelligence is expressed.

The underlying assumption of the study was that any variation in the linguistic symbol system of the individual (such as that caused by deafness or bilingualism) could, theoretically, have consequences not only for general reasoning processes but also for the use of other symbol systems (e.g. imagery).

Previous studies have tended to focus only on one level of cognition, i.e. the effects of bilingualism on general reasoning or operational thought processes, normally expressed as the relationship between bilingualism and I.Q. The possible effects of bilingualism on the facility with which the individual expresses his intelligence through different symbolic systems has not been explicitly considered.

The latter possibility was suggested by Vera John (1970) when she argued that bilingual children are often "caught between two languages" in the early school years and may rely more on imagery or what she calls "visual conceptualization" in organizing their world. In other words, she is suggesting that difficulties in coping with two languages may lead to linguistic interference and confusion in the bilingual child and cause him to think more in images as opposed to words.

The Theoretical Framework

The consideration of this question can only become meaningful when it has been explicitly related to broader theoretical issues in the field of cognitive psychology. Theories serve as direction posts for research and attempt to give meaning and coherence to the results of research. Therefore, the empirical investigation of the effects of bilingualism both on general reasoning and the individual's use of linguistic and imagistic symbol systems must be preceded by an examination of various theoretical positions on how linguistic and imagistic symbol systems relate to operational thought processes. The principal theories that will be considered in this regard are those of Piaget (1970) and Vygotsky (1962). It will be argued in this study that it is only on the basis of an initial distinction between the epistemological status of symbols and conceptual knowing that the question of how language and imagery relate to operational thought can be adequately resolved. This theoretical orientation is Piagetian in emphasis.

In order to develop a more adequate theoretical framework for the study of the relationships between bilingualism and cognition than has existed hitherto, the implications of both Piaget's and Vygotsky's theories for bilingual cognition will be examined in detail. It will be argued that both theories are capable of accounting for the observed effects of bilingualism on cognitive functioning; however, each theory is likely to invoke different theoretical constructs to account for these effects.

The theoretical rationale of most previous studies of bilingualism and cognition has been that bilingualism will affect cognitive processes only to the extent that linguistic symbolism is involved in the thinking process. This rationale is challenged in the present study on the basis that there are aspects of bilingual learning situations which may affect cognition in ways which are not directly mediated by language.

In summary, the theoretical analysis of the present study will attempt to show (1) that the theories of Piaget and Vygotsky on the role of language in cognitive growth are equally compatible with the observed effects of bilingualism on cognition; (2) that bilingualism can affect cognition in two qualitatively different ways - either through the direct influence of access to two languages, or in ways which are not directly mediated by language.

Overview

In chapter 2 previous studies of the effects of bilingualism on cognitive functioning will be considered. The theoretical analysis briefly outlined above will be considered in chapters 3 and 4 and in chapter 5 the theoretically possible effects of bilingualism both on operational intelligence and the use of linguistic and imagistic symbol systems will be examined. Subsequent chapters will deal with the methodology, results and implications of the empirical investigation.

CHAPTER 2

PREVIOUS STUDIES OF BILINGUALISM AND COGNITION

Historical Overview

The earliest systematic investigations of bilingualism and cognition were carried out by Ronjat (1913) and by Epstein (1918). Ronjat gives a detailed account of how his child acquired French and German simultaneously before the age of four. Epstein's study was concerned with the effects of multilingualism on a person's thinking processes and focussed on the interference, and in some cases facilitation between a multilingual's several languages.

The issues studied by Ronjat (1913) and Epstein (1918) are still very much alive in contemporary psychology. The simultaneous acquisition of two languages in early childhood has been investigated by Imedadze (1967) and Swain (1972, 1973), and bilingual storage and switching mechanisms have been the subject of studies by, among others, Kolers (1968), Macnamara (1967) and Neufeld (1973).

The orientation of research into the relationships between bilingualism and cognition changed radically with the introduction of standardized I.Q. tests in the early 1920's. I.Q. tests presented investigators with what appeared to be a straightforward means of discovering whether bilingualism affected intellectual abilities. However, many of the early studies which compared the I.Q. scores of unilinguals and bilinguals produced contradictory results and the only clear trend that emerged prior to the classic Peal and Lambert (1962) study was that bilinguals seemed to suffer from a language handicap when measured by verbal tests of intelligence (Darcy, 1953; Peal and Lambert, 1962). Peal and Lambert (1962) conclude their review of the literature on the effects of bilingualism on cognitive functioning as follows:

> "In view of the weakness of the studies reviewed, the best general conclusion is that there is little evidence to suggest that bilinguals differ from monolinguals on non-verbal intelligence, but that there may be differences in verbal intelligence as measured by intelligence tests (1962, p. 5)."

Both Peal and Lambert (1962) and Diebold (1968) point out that few studies proposed definite hypotheses to account for the bilinguals' lower verbal scores, save to appeal to ill-defined notions about "mental confusion" and "language handicap".

Two general types of inadequacies - empirical and theoretical - can be observed in the early studies. Empirical inadequacies were evident in the design of studies which failed to control for confounding variables such as socioeconomic status and the bilingual's knowledge of his two languages. Also the tests used were usually standardized on a white anglo-saxon population and administered to a culturally different bilingual group. Thus, due to cultural bias, many of these measures of the intelligence of bilinguals were of doubtful validity. In the case of psychological testing, as in many other fields, a new form of technology ("objective" tests which could be statistically manipulated) was developed much faster than the widsom which would specify the conditions under which this form of technology was useful and valid. The results of many of the early studies of bilingualism and intelligence which purported to show that bilinguals suffered from a language handicap can be attributed to this lack of sophistication in the use of I.Q. tests.

A more fundamental reason for the lack of progress in defining the relationships between bilingualism and cognition is that most of the earlier studies lacked adequate theoretical guidelines. In retrospect, it seems quite naive to have attempted to isolate a causal linkage between bilingualism and I.Q. with little consideration of what an I.Q. is, of what intelligence is and of what roles language and other representational systems might play in the development of thinking processes. Empirical studies of bilingualism and cognition were, for the most part, based on the results of previous empirical studies with little consideration of the broader theoretical context. This is partially excusable since there as yet existed no theory of intellectual development which could have provided a context in which to interpret the results. However, this does not alter the fact that because of this theoretical vacuum the results of even well-controlled studies added little to our understanding of how bilingualism affects cognition.

One study of bilingual language acquisition (Leopold, 1949) was not subject to the empirical and theoretical inadequacies of most of the early psychometric studies. In fact, Leopold's observations have far-reaching theoretical implications for the study of bilingualism and cognition; these implications will be considered within the context of the Peal and Lambert (1962) study.

The early studies of bilingualism and cognition have been well reviewed by Peal and Lambert (1962), Jensen (1962 a, 1962 b) and Macnamara (1966) and will not be considered at length here. Studies that came after the Peal and Lambert (1962) study have tended to be more sophisticated both in research design and theoretical content than the earlier studies, and since no review of these studies currently exists they will be dealt with in greater detail.

Recent Studies of Bilingualism and Cognition

Most of the more recent studies can be considered within the context of the Peal and Lambert (1962) study, since, for the most part, they represent attempts either to extend Peal and Lambert's empirical findings or further investigate the theoretical speculations which Peal and Lambert used to account for their results.

The Peal and Lambert (1962), study, carried out in Montreal with French-English bilinguals, was the first study to adequately control for socioeconomic class, sex, age and degree of bilinguality. Peal and Lambert (1962) found that their sample of balanced 10 year old bilinguals performed at a higher level than their unilingual counterparts on nonverbal tests involving concept formation or symbolic flexibility (e.g. Raven's Progressive Matrices). They were also superior on verbal measures of intelligence, although Peal and Lambert (1962) admit the possibility that the method of choosing the bilingual sample might be responsible for their higher level of verbal ability. In a later paper (Lambert and Anisfeld, 1969) they say that they were personally convinced that this was not the case. Factor analysis of the scores for the bilingual sample showed that intelligence variables defined more independent factors than in the unilingual sample. In other words, the bilinguals had a more diversified structure of intellect.

However, as Peal and Lambert (1962) point out, this might be due to the higher intelligence of the bilingual group rather than to their bilinguity.

Peal and Lambert (1962) propose several different hypotheses to explain their results. First, they hypothesise that

> "From an early age, bilinguals may be forced to conceptualize environmental events in terms of their general properties without reliance on their linguistic symbols. . .Leopold noted that his bilingual child learned to separate the sound of the word from the thing itself. The ability to think in terms of abstract concepts and relations, independent of the actual word, apparently is required in the symbolic reorganization type tests (1962, p. 14)."

Jensen (1962 b) mentions several investigators (Christopherson, 1948; Haugen, 1956; Hoffmann, 1934 and West, 1926) in addition to Leopold (1949) who

> ". . .assert that since the bilingualist has two terms for one referent, his attention is focused on ideas and not words, on content rather than form, on meaning rather than symbol, and this is highly important in the intellectual process (1962 b, p. 360)."

In order to appreciate this claim it is necessary to examine the relation between word and referent in the unilingual situation. This is expressed by Vygotsky (1962) as follows:

> "The word, to the child, is an integral part of the object it denotes. . .An exchange of names would mean an exchange of characteristic features, so inseparable is the connection between them in the child's mind. . .We can see how difficult it is for children to separate the name of an object from its attributes . . .(1962, p. 128-129)."

This separation is necessary before the child can conceptualize the essential attributes of the object. Vygotsky (1962) argued that writing acts to loosen the link between the linguistic context and the immediate referent. Leopold's (1949) observations of the simultaneous acquisition by his daughter Hildegard of English and German, indicate that bilingualism, in a somewhat similar manner, accelerates the separation of sound and meaning, or name and object. Peal and Lambert (1962) hypothesize that this looseness of the link between the phonetic word and its meaning, which Leopold attributed to bilingualism, might lead to quicker abstraction of the essential properties of objects.

It can be seen that many investigators from disparate fields have argued that a process similar to that suggested by Peal and Lambert's first hypothesis does in fact take place. However, the evidence for this process does not rest only on informal observation and conjecture. A recent empirical study in South Africa by Ianco-Worrall (1972) has shown that bilingual children do in fact separate sound and meaning earlier than unilingual children. Ianco-Worrall (1972) found that of the 4-6 year-old bilinguals in her sample, 54% consistently chose to interpret similarity between words in terms of a semantic rather than an acoustic dimension, whereas practically none of the unilingual group showed similar choice behavior. The author concludes that

> ". . .bilinguals, brought up in a one-person, one-language home environment, reach a stage in semantic development. . . some 2-3 years earlier than their unilingual peers. A high percentage of these bilingual youngsters perceived relationship between words in terms of their symbolic rather than their acoustic properties. . .(1972, p. 1398)."

Ianco-Worrall's (1972) empirical confirmation of Leopold's (1949) observation adds considerable weight to Peal and Lambert's (1962) attempt to explain the bilinguals' higher level of concept formation by means of this hypothesis.

Peal and Lambert's (1962) second hypothesis is that the bilingual child may have developed more flexibility in thinking. They suggest that the habit of switching from one language to another might lead to greater cognitive flexibility in the bilingual child and thus help him on tests requiring symbolic reorganization. Peal and Lambert's use of the term "flexibility" should be clarified. The actual performance to which they are referring is performance on a nonverbal reasoning test. The precise role of "flexibility" in this context is unclear but it should be emphasized that it has nothing to do with "creativity" or divergent thinking. This point is important because Peal and Lambert's results have been interpreted as support for the view that bilingualism might lead to a higher level of creativity. For example, Landry (1974), in discussing Peal and Lambert's results, says that the difference between the bilingual and unilingual groups "was precisely on the factor of flexibility, a divergent thinking task (1974, p. 10)." This is a gross misinterpretation of Peal and Lambert's findings. Peal and Lambert's theoretical speculations might lead one to hypothesize a positive correlation between bilingualism and either creativity or cognitive flexibility, but there is nothing in their empirical data which supports such a hypothesis.

A study conducted in Switzerland by Balkan (1970) also suggests that the habit of switching from one language to another might lead to a higher level of cognitive flexibility in the bilingual. Balkan (1970) states that in Peal and Lambert's (1962) study "flexibility" was confounded with intelligence and claims that his results show that flexibility is a correlate of bilingualism independently of intelligence. Balkan matched bilinguals and unilinguals on non-verbal intelligence and found that the bilingual group performed significantly better on two variables which he claims measure cognitive flexibility. One of these tests was similar to the Embedded Figures Test and involves an ability to restructure a perceptual situation (Figures Cachées). The other test requires a sensitivity to the different meanings of words (Histoires).

Balkan (1970) also found substantial differences between early and late bilinguals. Early bilinguals were those who learned their two languages simultaneously in a bilingual environment or before the age of four. Late bilinguals were those who learned their second language between the ages of four and eight. The late bilinguals were somewhat inferior to the control group on two verbal ability measures and only slightly superior on the "flexibility" measures. The superiority of the early bilinguals over their matched unilingual counterparts was much more pronounced. Balkan (1970) explains his results as follows:

> "Nous expliquons ces résultats par le changement de perspective qu'entraine un changement de code; cela développe chez ces sujets une souplesse d'esprit qui, à son tour, les aide dans la resolution de problèmes nécessitant une restructuration des données (1970, p. 101)."

A study concerned with the relationship between second language learning and divergent thinking abilities carried out by Landry (1974) found that children exposed to a FLES program (20-45 minutes of instruction per day) scored significantly higher on both the verbal and figural parts of the Torrance Tests of Creative Thinking than a control group at the grade 6 but not at the grade 4 level. The author argues that learning a second language leads to a more flexible learning set since

> "Someone who was stimulated to switch from one linguistic context to another in his daily routine would be forced to maintain a certain adaptability and willingness to change (1974, p. 13)."

The differences between the two grade levels are attributed to the fact that reading and writing in the second language are introduced in the fourth grade and this leads to a conscious contrasting and comparing of one language with another. It is not clear, however, why this factor should have any influence on divergent thinking.

Landry's (1974) study is of doubtful relevance since there is no evidence that the subjects were in any sense balanced bilinguals. Also, although the schools were matched on SES in the sense that they tended to draw from the same area of the city, there was no SES matching of individual students. It could be argued that parents who send their children to a FLES school are more aware of the cultural value of a second language and therefore are likely to provide a higher level of cultural stimulation for their child than parents who send their children to a non-FLES school.

In summary, the essence of Peal and Lambert's second hypothesis is that the habit of switching languages could lead to a greater degree of plasticity or suppleness of mind in the bilingual. While there is relatively strong evidence for such a phenomenon, a more precise definition is required of what this suppleness or flexibility entails. How does "flexibility" as used by Balkan (1970) (= performance on perceptual and verbal "set changing" tests) relate to Peal and Lambert's

(1962) "flexibility" (= performance on a general reasoning test) or to Landry's "divergent thinking" (= performance on the Torrance tests of creative thinking)? How does the "cognitive flexibility" discussed by these authors relate to the "attitudinal flexibility" reported in several of Lambert's studies (Gardner and Lambert, 1972)? Unless this type of question is answered, the term "flexibility" will be so broad and ill-defined as to be useless for describing or accounting for differences between unilinguals and bilinguals.

Peal and Lambert's (1962) third hypothesis, which they propose as a possible explanation both for the bilingual's superior performance on the general reasoning tests and for their more diversified structure of intellect, is that the bilingual child has been exposed to a wider range of experiences than the unilingual due to the fact that his experiences stem from two cultures. A similar type of explanation has been proposed by Liedke and Nelson (1968). These authors found that bilingual grade 1 children performed better on a Piagetian concept formation task than a unilingual group matched for age, socioeconomic status, sex and I.Q. These authors conclude that

> "The results of this study seem to indicate that becoming bilingual speeds up the normal process of some parts of mental development (1968, p. 231)."

- specifically parts related to concept formation. They hypothesize that the bilingual child is exposed to a wider range of experiences due to the greater amount of social interaction involved in learning two languages as compared to one.

Recent research by Bain (1973) investigated whether access to and use of two language systems resulted in differences in perform-

ance on a problem solving task that required logical operations. Both balanced bilingual and unilingual groups (N=10 in each group) were matched for developmental level of operations and also for I.Q., socio-economic status and school grades. The purpose of matching the groups on these measures was to isolate language from the constellation of variables. Despite being matched on level of operations the bilingual group was, on average, five months younger than the unilingual group (11 years, 2 months vs. 11 years, 7 months). Bain (1973) points out that this fact is suggestive of further inquiry.

The bilingual and unilingual groups were compared on a task which required the discovery and generalization of a rule. No differences were found in time taken to transfer the rules but the bilinguals were more likely to discover the rules faster than the unilinguals (p=.17, two-tailed test).

At a younger age level (range 6.1 - 8.2 years), using the same task and research design, Bain found a much larger difference between bilingual and unilingual groups (p=.04, two-tailed test).[1] This result is consistent with Liedke and Nelson's (1968) findings and suggests that there is a developmental trend in the influence of bilingualism on cognitive functioning. Bilingualism appears to have a greater effect at the beginning of concrete operations than at the beginning of formal operations. Bain argues from this that the influence of language as as a lure to cognition is greater at younger age levels and tends to "go underground" as formal operations approach.

In addition to these studies, longitudinal evaluations of bilingual elementary school programs provide evidence that bilingual schooling has positive cognitive effects. For example, Lambert and Tucker (1973), in describing the St. Lambert project in Montreal, report that by grade 5 the children in the experimental group generally perform better on measures of verbal intelligence and perform as well as or better than the control groups on measures of creativity. Lambert and Tucker (1972) suggest that there is a positive transfer of skills across languages and the bilingual child's vocabulary and understanding of complex linguistic functions is increased by comparing and contrasting his two languages. This suggestion is supported by recent results from the bilingual program of the Ottawa Separate School Board. Casserly and Edwards (1973) report that children in the bilingual program perform significantly better than children in the normal school program on several measures of psycholinguistic abilities. The differences at the grade 3 level are even greater than the differences at the grade 1 level. Consistent with the hypothesis of linguistic enrichment due to bilingualism are the findings of Kittell (1963) who reports that between grades 3 and 5 bilingual children made significantly greater mean gains in language mental age ($p < .001$) and reading age ($p < .01$) than unilingual children.

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[1] Bain - personal communication

The results of the antecedent studies, all of which report some type of linguistic enrichment due to bilingualism, suggest that perhaps Peal and Lambert's (1962) findings of a higher level of verbal intelligence in their bilingual group is less of a sampling artifact than these authors imply.

The main effects of bilingualism on cognitive functioning, as reported by Peal and Lambert (1962) and subsequent investigators, and the suggested explanations of these effects are summarized in Table 1.

As can be seen from Table 1, results to date seem to indicate that bilingualism has a facilitating effect both on general reasoning or concept formation and on verbal intelligence. There is also some evidence that it leads to a greater degree of cognitive flexibility (Balkan, 1970).

Only the effects of bilingualism on cognitive functioning have been presented in Table 1. Differences have also been found between bilinguals and unilinguals on other aspects of mental life (see Gardner and Lambert, 1972), but these differences are not immediately relevant to the present study.

In conclusion, this review of the literature has shown that there is substantial evidence that bilingualism has wide-ranging effects on different aspects of cognitive functioning. In the next chapter the problem of cognitive representation will be considered as a prelude to the development of a theoretical framework for the study of bilingual cognition.

TABLE 1

Summary of the Observed Effects of Bilingualism on Cognition and the Suggested Explanations of these Effects

A. Linguistic Effects	Explanations
(1) higher verbal intelligence (Peal and Lambert, 1962)	(a) sampling artifact (Peal and Lambert, 1962)
(2) greater increase in verbal intelligence between grades 3 and 5 (Kittell, 1963)	(b) overlap of French and English vocabulary (Peal and Lambert, 1962)
(3) higher level of psycholinguistic abilities (Casserly and Edwards, 1973)	(c) transfer across and comparison of languages (Lambert and Tucker, 1972)
B. Non-linguistic Effects	**Explanations**
(1) higher general reasoning ('g') (Peal and Lambert, 1962)	(a) faster separation of sound from referent (Peal and Lambert, 1962) (empirically supported by Ianco-Worrall, 1972)
(2) greater diversity of intellect (Peal and Lambert, 1962)	(b) wider range of experiences due to participation in two cultures (Peal and Lambert, 1962)
(3) higher level of concept formation (Liedke and Nelson, 1968)	(c) greater degree of social interaction (Liedke and Nelson, 1968)
(4) greater cognitive flexibility (Balkan, 1970)	(d) habitual switching from one language to another (Peal and Lambert, 1962) (Balkan, 1970)
(5) faster rule discovery (Bain, 1973)	

CHAPTER 3

THE PROBLEM OF COGNITIVE REPRESENTATION

Introduction

In the previous chapter both the observed effects of bilingualism on cognitive functioning and the explanations which have been suggested to account for these effects were outlined. The purpose of this and the next chapter is to place these explanations into a broader psychological context and to provide a theoretical framework for the investigation of the influence of bilingualism on cognitive functioning.

The problem of cognitive representation is basically the problem of how symbol systems (language and imagery) relate to conceptual or operational knowing. It is important to consider this relationship because bilingualism, like deafness and blindness, introduces a change at the level of symbol systems. Although, unlike blindness or deafness, the bilingual's access to two linguistic symbol systems does not constitute any obvious facilitation or deficiency at this level, the change that it causes is potentially important for cognitive functioning. In discussing the relationships between bilingualism and cognitive representation we want to discover what, if any, effects this change at the level of the linguistic symbol system might have both on the bilingual's operational intelligence and on his use of the imagistic symbol system. It is therefore clear that the relationships that exist between both the linguistic and imagistic symbol systems on the one hand, and operational intelligence on the other, must be thoroughly explored.

The most sophisticated account of this relationship, and the one which the writer believes is best supported by the empirical evidence, is that of Piaget (1970). Piaget's theory of cognition will be contrasted with Vygotsky's (1962) theory and in the next chapter, the implications of both theories for the problem of how bilingualism influences cognition will be drawn out.

Piaget's Theory

Piaget's account of the development of logical thought is distinguished from most other theories of cognitive development by his contention that the genesis of conceptual structures cannot be accounted for by the influence of language or other symbol systems. Furth (1969) points out that

> "Piaget's theory of operative knowing is unique in dispensing with a mediational representation as far as the essential aspect of critical, objective knowing is concerned (1969, p. 75)."

Furth (1969) goes on to show that many theorists in the empiricist tradition, fail to distinguish between the conceptual knowledge that a person has and the symbols he uses to represent this knowledge. In this category, Furth places the theories of Tolman (1932), Berlyne (1965), Osgood (1952), Vygotsky (1962) and Miller, Galanter and Pribram (1960). The common element in these theories, according to Furth (1969), is that internalized symbols are conceived as co-extensive with knowledge and constitute the chief explanatory factor for intelligent behavior. Furth points out several epistemological difficulties in this assumption and argues that an adequate theory of cognition must make an explicit distinction between the reality status of symbols and conceptual or operational knowing. Pylyshen (1973) makes basically the same point and argues that we cannot explain a person's "knowledge" by reference to imagistic or linguistic symbols. He points out that

> ". . .we cannot assume that the contents of such subjective knowledge can be identified with the kind of information processing procedures which will go into an explanatory theory (1973, p. 3)."

What is the relationship between symbols and operational intelligence in Piaget's theory? The basic activity of operational thinking is described by Furth (1969) as follows:

> "Operative thinking. . .does not represent but implicitly transforms a reality state according to its own structure; this internal action constitutes the basic action of intelligent understanding (1969, p. 105)."

Symbols, on the other hand, are not essential components of the person's knowing activity; they are not an inherent part of operative intelligence. A symbol represents a state of knowing and finds its explanation in that knowledge. The symbolic or semiotic function is the person's capacity to construct or produce a symbol to represent that which the person knows and which is not present. Thus, all symbols (words, images, drawings, etc.) presuppose the constructive activity of operational thinking and depend on it. Language differs from other symbols in that it is not figuratively related to the objective configuration, but it too is part of the semiotic function and does not enter directly into the operative component.

In summary, the Piagetian position is that symbols can be considered a supportive but not a constitutive element of operativity.

How do imagery and language relate to operational intelligence ? in the process of development? Piaget's (1970) position is that although both imagery and language can serve to promote operational thought in various ways, they cannot, by themselves, be invoked as explanatory factors for changes in the basic structure of operations.

Imagery and thought. Piaget and Inhelder (1966) propose that there are two distinct stages in the evolution of imagery. Imagery of a static and "reproductive" kind first emerges at the age of 1½ to 2 years and continues throughout the preoperative stage. With the development of concrete operational thought "imagery gradually acquires sufficient mobility to become anticipatory (Inhelder, 1965, p. 16)." Anticipatory imagery allows the child to represent first the results of transformations of the stimulus situation, and then the successive steps of such transformations. The developmental relationship between anticipatory imagery and operational thought is clearly expressed in the following quotation from Inhelder (1965).

> "Although it is true that symbolic imagery, because of its imitative quality, never attains the dynamics of operative construction and does not constitute an element of thought on an equal footing with operativity, it nevertheless fulfils the role of a symbolic tool that is complementary to that of language and like language promotes the progress of thought (1965, pp. 17-18)."

Independent studies of Piaget's account of the emergence of anticipatory imagery indicate that it develops as Piaget has suggested and that the child's visual imagery abilities are determined by the operational level of the child (Robertson, 1970; Youniss and Robertson, 1970; Lipton and Overton, 1971). Thus the Piagetian position can be summarized by saying that the ability to employ anticipatory images is dependent on the logical reorganization of thought which takes place as a consequence of the emergence of the concrete operational stage.

Language and thought: In Piaget's theory language is one of the mainfestations of symbol functioning and is acquired and used like other symbol behavior. Language is defined by Furth (1969, p. 262) as the "natural spoken (and heard) symbol system of communication typical of a society" and, he says, it chiefly influences intelligence indirectly through the social, educative impact of society. It can be seen that this is a relatively narrow definition of "language" which does not a priori include any "meaning" or conceptual content.

The advantage of the Piagetian framework, as Furth (1966) points out, is that within it language as a symbol system is objectively differentiated from thinking, and it is only on the basis of this differentiation that the question of the mutual relation between language and thinking can legitimately be raised. When the initial unit of analysis is a union of the linguistic (symbolic) and conceptual level (for example, the behaviourist's "verbal mediation", Vygotsky's (1962) "word meaning" or "inner speech", Bruner's (1966) "symbolic representation") the relationship between operational thought and language becomes extremely confused. This will be illustrated when Vygotsky's (1962) notion of "inner speech" is considered.

Piaget (1969, p. 120) argues that language "is in no way sufficient to assure the transmission of operational structures ready made". He does not deny that language as part of the semiotic function releases the child from the immediate here and now and increases the range and power of operations; however, he argues that "language does not constitute the source of logic, but is on the contrary, structured by it (Piaget and Inhelder, 1969, p. 90)."

The origin of logical operations lies in the laws of the general co-ordinations of action which control all activities including language itself. Piaget (1969) postulates a genetic relationship between mature operations and early sensory-motor coordinations. For example, the operation of adding two numbers (2+2=4) derives from the action of uniting objects. In short, logical operations _are_ internalized actions.

The capacity to use language logically depends on prior conceptual or operational growth. Piaget expresses this as follows

> ". . .a verbal transmission that gives adequate information relative to operational structures is only assimilated at levels where these structures have already been assimilated on the plane of actions or of operations as interiorized actions (1969, p. 127)."

In other words, the child's intellectual growth derives from internalized actions and his use of language is determined by the developmental level of his operative structures.

According to Piaget (1970) four factors are influential in promoting development. These are maturation, experience with objects, social transmission and equilibration. All these factors interact in the process of development and none of the factors _per se_ is sufficient to explain cognitive growth. Thus, Piaget objects to the strong emphasis placed by some theorists (e.g. Vygotsky, 1962; Bruner, 1966) on one particular social factor - i.e. language - in accounting for the development of logical thinking. The effects of cultural or social transmissions in directing cognitive growth have been well documented (e.g. Cole, Gay, Glick and Sharp, 1971) and Piaget (1970) admits that the child's cultural or educational environment can accelerate or retard the development of cognitive structures. However, when the effects of language are isolated from social interaction, as in the studies of the deaf, who are exposed to a social, but not a linguistic environment, one finds that language *per se* has little effect on the overall development of operational structures (Furth, 1966; Vernon, 1967).

Empirical basis of Piaget's theory: Piaget's theory is supported by studies of the cognitive effects of deafness (Furth, 1966) and by Sinclair-de-Zwart's (1967) studies of the linguistic usage of operational and preoperational children.

Furth's (1966) studies of deaf children have shown that the absence of language does not prevent these children from attaining formal operations. Although the deaf lack information, show a minimal degree of intellectual curiosity and tend to be insecure and passive in unstructured situations, the basic development and structure of their intelligence is remarkably unaffected by the absence of verbal language. Furth attributes the few observed intellectual deficiencies of the deaf to experiential factors such as the lack of normal social interaction rather than to the direct influence of language.

Furth admits that the deaf child's experiental deficiency is related to his lack of linguistic competence; however, one must, he says, differentiate a direct from an indirect influence and not attribute to language what should properly be said of experience. This distinction between the direct and indirect influences of language on cognitive functioning will be elaborated upon in a later chapter when the theoretically possible ways in which bilingualism might affect cognition are discussed.

Results not entirely consistent with Furth's (1966) data have been reported by Pettifor (1968). Pettifor found that deaf children were inferior to hearing on a task which required a relatively abstract level of conceptualization and argued from this that conceptual thinking is dependent on language. However, this result does not concur with the vast majority of the studies of the cognitive capacities of the deaf. Vernon (1967) has surveyed 33 studies which compared the performance of hearing-impaired and normal control subjects on a variety of different performance tests of intelligence. The results indicated that the impaired and normal subjects generally performed equally well on the tests and Vernon concluded that there is no functional relation between verbal language and thought processes. This conclusion is in agreement with Furth's (1966) data and with Rosenstein's (1961) earlier review of the literature on cognition in deaf children.

Piaget's action-based theory of cognitive development receives further support from studies of the blind (Hatwell, 1960) who are, on average, four years behind normal in operational level. This is attributed by Piaget and Inhelder (1969) to the fact that the verbal acquisitions of the blind cannot compensate for the inhibition of sensori-motor schemes caused by blindness.

Another strong line of evidence comes from the studies of Sinclair-de-Zwart (1969) which claim to demonstrate that in school-age children the development of the basic cognitive schemata owe little to language. Sinclair-de-Zwart examined differences in linguistic usage between pre-operational and operational children. She found that the pre-operational group used mainly non-relational terms (X long, Y short) whereas operational subjects used relational terms (X longer, Y shorter). Thus, there was a clear relation between linguistic usage and operational level; but in which direction? After instruction in the verbal forms only 10% of the non-conservation subjects showed conservation. Piaget (1970), in discussing these results, concludes

> ". . .language does not seem to be the motor of operational evolution but rather an instrument in the service of intelligence itself (1970, p. 722)."

What contributions does language make to the development of intelligence? Sinclair-de-Zwart (1967) sums up the contributions of language to intellectual growth as follows:

> "Language can direct attention to pertinent factors of a problem, just as it can control perceptual activites, as Luria and his collaborators have shown. In this way, language can prepare an operation but is neither sufficient nor necessary to the formation of concrete operations (quoted by Furth 1969, p. 130)."

Vygotsky's Theory

The theories of Vygotsky (1962) and Luria (1961) emphasize that logical thought is made possible through the internalization of speech.

Vygotsky's theory, consistent with a Marxist viewpoint, emphasizes the social origins of consciousness. The specifically human mode of cognizing is learnt from others through the mediation of language. Speech and thought, according to Vygotsky (1962), spring from different roots and are separate functions until about the age of two when a synthesis begins to occur. This synthesis represents a totally new mode of cognition which is not found in lower animals. Vygotsky's central concern in "Thought and Language" is to describe the characteristics of this new form of cognition which is initiated by the fusion of speech and thought.

Vygotsky lucidly describes the gradual internalization of inner speech and its functions first, in the social and affective spheres, and then as a regulator of the child's own behavior. The experiments of Luria (1961) have documented how the internalization of the speech of others allows the child to become an independent organism who both thinks and controls his own behavior by means of inner speech.

For Vygotsky inner speech is a function in its own right sharply differentiated from external speech. It is a form of thinking through meanings. The unit of analysis is "word meaning" which is both verbal and intellectual.

Although Vygotsky (1962) emphasizes that the development of logical thought is dependent on the internalization of speech, he does not identify inner speech with thought. Thought has its own structure and there is no rigid correspondence between the units of thought and speech. According to Vygotsky (1962, p. 150), a thought may be compared to a cloud shedding a shower of words. In a person's mind the whole thought is present at once but in speech it must be developed successively.

Vygotsky's treatment of "thought itself" is rather vague, and, as Langer (1969) points out, he does not specify how it develops in the child. Also, although Vygotsky's analysis of inner speech is useful in pointing to some of the dynamic aspects of the relationship between language and thought, the exact status of the relationship between inner speech and thought is unclear as Furth (1969) shows in the following passage.

> ". . .frequently inner language seems to be understood as a general capacity of internal representation, perhaps identical with what Piaget calls the symbolic function in general. Or is inner language linguistic competence. . .Or is the knowledge of articulated words, of the names of things and of classes? If it is any of these does it include the operative aspect of thinking? In that case what is the meaning of a synthesis of thinking and inner language when the second term by definition includes thinking and perhaps is nothing but thinking? If it is not included, the crucial question about the relation of intelligence to symbol behavior. . .remains unsolved (1969, p. 118)."

Leontiev (1973) has been more explicit in distinguishing inner speech from thought. He warns against confusing the inner speech that attends thought with what he calls "inner programming". Thought is identified as problem-solving and "it by no means has to be verbal problem solving (1973, p. 51)."

> "What we have said does not mean that we completely sever thought from speech. The two are intimately connected,. . . but they are not the same (1973, p. 51)."

However, despite the vagueness that attends the relationship between thought and inner speech in Vygotsky's (1962) treatment, his basic position is clear i.e. the development of logical thought is made possible through the internalization of speech, and language elaborates and expands the entire mental life of the child. This is clearly expressed by Bain (1973) when he says

> "Thus Vygotsky's basic position is that not only operative thought, but the totality of emotional, perceptual, social and personality phenomena are intimately integrated with linguistic experience (1973, p. 3)."

Conclusion

There are two basic differences between Piaget's theory and that of Vygotsky. In Piaget's theory language as part of the semiotic function is clearly distinguished from operational thought. As Furth's (1969) criticism (see page 30) demonstrates, this is not the case in Vygotsky's theory.

The second basic difference is the role each theorist attributes to language in cognitive development. For Vygotsky, logical thought is made possible through the internalization of speech. Piaget, on the other hand, argues that the development of operational thought cannot be explained by the influence of language. The empirical evidence reviewed on pages 26-28 supports Piaget's position rather than that of Vygotsky on this particular issue.

The problem in the next chapter is to draw out the implications of both these theories for the study of the relationships between bilingualism and cognition. It was pointed out in this chapter that Piaget's theory is compatible with the effects of both deafness and blindness on cognitive growth. The question of whether it is similarily compatible with the observed effects of bilingualism on cognition will be considered in the next chapter.

CHAPTER 4

THE IMPLICATIONS OF THE THEORIES OF PIAGET AND VYGOTSKY FOR BILINGUAL COGNITION

This chapter is concerned with the implications of the theories of Piaget and Vygotsky for the question of how bilingualism is likely to affect intellectual functioning. It will be argued that both theories are capable of accounting for the observed effects of bilingualism on cognition but each theory is likely to interpret these effects in different ways. Since Piaget's theory on the role of language in cognitive growth is strongly supported by the empirical evidence, this chapter will attempt to develop a theoretical framework for the study of bilingual cognition which is consistent with Piaget's views on this issue.

Vygotsky's Theory and Bilingualism

Vygotsky (1962) has briefly considered the effects of learning a foreign language on cognitive growth. He argues that the process of comparing and contrasting two languages can bring to the child's conscious attention the operations that can be performed in each language.

> ". . .a foreign language facilitates mastering the higher forms of the native language. The child learns to see his language as one particular system among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations. Goethe said with truth that 'he who knows no foreign language does not truly know his own' (1962, p. 110)."

Lambert and Tucker (1972, p. 210) say that Vygotsky would not have been surprised by the "two-way bilingual relay of concepts and linguistic principles" that they have observed in the children in the St. Lambert project and he would probably expect an intellectual advantage to show itself as the children approach bilingual balance.

In an article on childhood bilingualism Vygotsky (1935) reviewed the research literature on the influence of bilingualism on cognition up to his time. He criticizes Epstein's (1918) findings regarding the interference among a multilingual's several languages because of the associationist psychology on which Epstein's study is based and he says that many educator-linguists point to Ronjat's (1913) work as evidence that the child's bilingualism can lead not only to mutual interference between the two languages but can also serve as a powerful factor in promoting cognitive development. Bilingualism in this view, Vygotsky says, can accelerate the genesis of the activities of comparison and differentiation and can lead to a realization of the limitations of verbal concepts and to the understanding of fine nuances in word meanings.

Vygotsky (1935) goes on to consider the early psychometric studies of bilingualism and I.Q. and challenges the assumption that so-called "non-verbal" tests of intelligence are independent of speech processes. Even if some non-verbal tests do not require the direct participation of inner speech at the moment of solution, Vygotsky maintains that they are nonetheless dependent on inner speech processes since the internalization of speech formed a necessary condition for the development of the child's intellect. Vygotsky argues that the question of the influence of bilingualism on cognitive growth must be studied from within the context of the role of speech in the development of cognitive processes.

> "There is much theoretical and empirical evidence to support the view that not only the child's intellectual development, but also the formation of his character, emotions and personality as a whole is found in direct dependence on speech and consequently . . .the problem of bilingualism ought to have been studied within the context of its influence on the development of the child's personality as a whole (1935, p. 69).[1]"

Unfortunately, Vygotsky's analysis ends with this call for a reorientation of empirical research on the effects of bilingualism and he does not explicitly relate the question of bilingualism to the internalization of speech. However, it is clear that Vygotsky believed that bilingualism could have positive effects on mental development and such a belief is consistent with his theory of intellectual growth. In fact, the strong emphasis which he places on the influence of speech in the development not only of intelligence but also character, emotions and personality, suggests that if he had access to recent research results (see chapter 2) he might have argued that bilingualism restructures the entire mental life of the individual and that the bilingual mode of cognition is qualitatively different from that of the unilingual.

Piaget's Theory and Bilingualism

Unlike Vygotsky, Piaget has not considered the question of how bilingualism might influence cognition. It has been implied (Macnamara, 1970; Bain, 1973), however, that Piaget's position on the developmental relationship between language and thought is incompatible with the hypothesis that bilingualism accelerates cognitive development. This assumption is shared by both Bain (1973) and Macnamara (1970) despite the fact that in other respects their analyses of bilingual cognition are diametrically opposed. Bain (1973), for example, argues that the bilingual's "more complex linguistic mode" accelerates aspects of cognitive growth whereas Macnamara's (1970) position is that bilingualism is unlikely to have any effect on the development of either intelligence or creativity. Both these positions will be briefly outlined and the assumption common to both positions (i.e. that no differences would be predicted between bilinguals and unilinguals on the basis of Piaget's theory) will be challenged.

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[1] The writer is indebted to Patrice Johnson and Dr. Metro Gulutsan for making this translation available.

Bain's argument: Bain (1973) attempted to integrate the theories of Piaget and Vygotsky by investigating differences between bilinguals and unilinguals on a task which required the discovery and generalization of a rule. No differences were found in time taken to transfer the rules but the bilinguals were more likely to discover the rules faster than the unilinguals. Bain argues from these results that a more complex linguistic mode (i.e. a bilingual mode) does lead one to certain phenomena more readily and thus Vygotsky's thesis that language acts as a lure to development is supported. The finding of no difference in generalizability between the groups supports Piaget's thesis that "internalized action, not language *per se*, is at the root of higher level thought (Bain, 1973, p. 10)." Thus, differences between bilinguals and unilinguals, in favour of the bilinguals, were interpreted as support for Vygotsky's theory, whereas no differences were assumed to constitute support for Piaget's theory.

Macnamara's argument: Macnamara's (1970) theoretical analysis of bilingualism and thought is aimed at showing that bilingualism is unlikely to have any effect on either intelligence or creativity. He points out

> "The fears, or hopes, which caused people to study the relationship between bilingualism and I.Q. seem to spring from the general view that language either constitutes or creates intelligence (1970, p. 34)."

Macnamara rejects this view and argues that linguistic functioning is to a great extent dependent on many sorts of non-linguistic cognitive functioning. In support of this contention he quotes the studies of Sinclair-de-Zwart (1967) which show that the development of the basic cognitive schemata owe little to language and that developments in linguistic usage depend on prior non-linguistic growth. Against the background of his theoretical analysis of language and thought Macnamara concludes that

> ". . .it seems unlikely that bilingualism should have any effect upon the development of the basic, common, cognitive structures (1970, p. 33)."

Macnamara's argument can be by-passed if one denies his claims that linguistic functioning is to a great extent dependent on non-linguistic functioning and does not play a crucial role in cognitive development. If one holds that language is central in the development of logical thought then one has rejected Macnamara's premise and his conclusion poses no problems. However, the present writer believes that this position is not in accordance with the empirical findings and is in full agreement with the position put forward by Macnamara.

It will be argued that one can accept Macnamara's premise (i.e. language is inessential for the development of operative thought) and reject his conclusion that bilingualism is unlikely to have any effect on the development of intelligence. In other words, it will be argued that there is no contradiction between Piaget's position on the language-thought issue and the hypothesis that bilingualism significantly affects the development of intelligence. This argument involves a distinction between two qualitatively different ways - "linguistic" and "non-linguistic" - in which bilingualism can affect cognition.

Linguistic and Non-linguistic Aspects of the Bilingual Situation

The bilingual's experience differs from the unilingual's not only by the fact that he has access to two verbal codes in comparison to the unilingual's one, but also by several factors which, although they derive from the primary linguistic difference, are not in themselves linguistic.

As an example of what is meant, consider Furth's (1966) studies of the effects of deafness on cognition. Furth found no cognitive deficiencies which could be attributed to the specifically linguistic factor (the fact that the deaf are linguistically deprived) and he argues that experiential factors, such as the lack of normal social interaction in the deaf, can account for most of the deficiencies which were found.

In a similar fashion, it can be argued that there are two general ways in which bilingualism might affect cognitive growth, - the specifically linguistic and the non-linguistic. Macnamara's (1970) analysis is deficient in that it fails to take any account of non-linguistic factors which may differentially influence the cognitive development of bilinguals and unilinguals. The distinction between linguistic and non-linguistic explanations has not been formally recognised up to now, although several investigators (see Table 1, page 19) have proposed non-linguistic explanations to account for observed differences in the cognitive functioning of bilinguals and unilinguals.

The assumption that Piaget's theory is inconsistent with the hypothesis that bilingualism influences cognitive growth is unsound, firstly, because in addition to the effects of bilingualism on cognition which are due to the specifically linguistic factor (access to two verbal codes rather than one), there are effects which are extrinsic to, or by-products of, the fact that the bilingual has access to two linguistic systems. Secondly, the fact that language (in the unilingual situation) may not play an essential role in the development of cognitive structures does not necessarily mean that certain linguistic features of the bilingual situation will have no effect on the speed with which certain concepts are grasped in ontogenesis.

Non-linguistic Explanations

The rationale - either implicit or explicit - for many of the previous studies of bilingualism and cognition was that language is somehow crucial for the development of logical thought. If this is so, any differences in the linguistic medium are likely to have some effect on thought processes. Thus, it is logical to expect differences between bilinguals and unilinguals with respect to intelligence .

Even investigators who have argued that language and intelligence only partially overlap have tacitly assumed that bilingualism will only influence cognition to the extent that language interacts with cognitive processes. This is illustrated by Arsenian (1937) when he says

> ". . .the influence of bilingualism. . .does not extend to the whole area of thinking or intelligence, but to that particular section where linguistic symbolism and schemata are involved in the thinking process (quoted by Peal and Lambert, 1962, p. 5)."

This rationale, which is also implicit in Bain's (1973) and in Macnamara's (1970) analyses, fails to take account of non-linguistic aspects of the bilingual situation which are potentially important in accounting for differences between the cognitive abilities of bilingual and unilingual children. Non-linguistic explanations involve accounting for the effects of bilingualism on cognition by reference to factors which are extrinsic to, or by-products of the fact that the bilingual has access to two linguistic systems. An examination of Table 1 shows several suggested explanations which fall into this category. For example, Liedke and Nelson (1968) suggest that the greater amount of social interaction which is presumably involved in learning two languages at an early age accounts for the higher level of concept formation which they found in their bilingual grade 1 group. Similarily, Peal and Lambert (1942) argue that the bilingual is exposed to a wider range of experiences due to his participation in two cultures. In these explanations no explanatory role is attributed to the linguistic factor. The influence of bilingualism on cognition is attributed to cultural or social aspects of the bilingual situation.

It might be argued that it is impossible to make this distinction since linguistic and social factors are very much intertwined in the process of development. However, Furth's (1966) studies of the cognitive effects of deafness demonstrate that it is possible to distinguish between the direct effects of language _per se_ and effects which are more directly attributable to non-linguistic factors. The same reasoning applies in the bilingual learning situation; one must differentiate a direct from an indirect influence and not attribute to linguistic aspects of the bilingual situation what should properly be attributed to experiential factors.

A different type of non-linguistic explanatory variable has been suggested by both Peal and Lambert (1962) and Balkan (1970) to account for the bilingual's greater cognitive flexibility. They argue that the habit of switching languages and making use of two different perspectives develops in the bilingual "une souplesse d'esprit" which helps him in tasks requiring perceptual or conceptual reorganization. This explanation is non-linguistic in that it does not emphasize the effects of the _specifically linguistic_ variable (two verbal codes rather than one) on cognition. The fact that the switching is between two languages is not intrinsic to the explanation. The _causal_ element is the switching of perspective rather than any specifically linguistic factor.

The existence of these non-linguistic ways in which bilingualism might affect cognitive processes refutes the theoretical rationale (often implicit) of many previous studies and also the tacit assumption underlying Macnamara's (1970) theoretical analysis of bilingualism and thought.

Linguistic Explanations

Linguistic explanations account for the effects of bilingualism on cognition as a direct result of the fact that the bilingual has access to two verbal codes. Several different types of linguistic explanations have been suggested to account for the observed superiority of bilinguals on tests of general reasoning and verbal intelligence. Peal and Lambert (1962), for example, have suggested that the overlap of French and English vocabulary could account for the bilingual's greater verbal ability and Lambert and Tucker (1972) suggest that transfer across and comparison of languages might have the same effect. Peal and Lambert (1962) explain the bilingual's higher level of concept formation by arguing that because the bilingual child has two words for the same referent his attention is drawn to the essential or conceptual properties of things. This explanation is "linguistic" in that the higher level of concept formation is explained as a direct result of the fact that the bilingual has two words for the same referent. Similarly, many earlier studies made use of "linguistic" explanations in that they attributed the bilinguals' lower verbal intelligence to inability to cope with two language systems.

Do these attempts at "linguistic" explanations not contradict the Piagetian view that linguistic functioning is dependent on non-linguistic cognitive functioning? No. The role which Piaget attributes to language in intellectual growth is perfectly compatible with these "linguistic" explanations. The Piagetian view is expressed in the following quotation:

> "First, language training. . .operates to direct the child's interactions with the environment and thus to "focus" on relevant dimensions of task situations. Second,. . .language does aid in the storage and retrieval of relevant information. However, our evidence offers little if any support for the contention that language learning per se contributes to the integration and coordination of 'informational units' necessary for the achievement of the conservation concepts (Inhelder, Bovet, Sinclair and Smock, 1966, p. 163)."

In short, the Piagetian view is that while changes in operational thought structures cannot be explained by the influence of language, language does aid logical thinking by enabling the child to focus more efficiently on, and to fixate the relevant features of the problem situation.

This view on the influence of language is in no way incompatible with Leopold's (1949) observation that because the bilingual child has two words for the same referent, his attention is directed to the essential or conceptual features of objects, or with Peal and Lambert's (1962) hypothesis that this can accelerate the process of conceptual development. Piaget's account of the role of language in the unilingual situation emphasizes that language directs the child's attention to relevant aspects of the environment; in the bilingual situation where there are two forms of linguistic input, this process is likely to operate to a much greater extent and draw the child's attention not only to aspects of the outside environment but also to features of his two languages themselves. Thus, as Vygotsky (1962) and Lambert and Tucker (1972) have noted, the bilingual child will be led to compare and contrast the operations that can be performed in each language.

In summary, when Piaget's account of the role of language in the unilingual situation is extrapolated to the bilingual situation, it can be shown to be highly consistent with the hypotheses that bilingualism (a) accelerates conceptual development and (b) increases the linguistic skills of the individual.

Comparison of Piagetian and Vygotskian Interpretations

Despite the fact that the theories of Piaget and Vygotsky are equally compatible with the observed effects of bilingualism on cognition, each theory is likely to invoke different theoretical constructs to account for these effects. Because of its emphasis on the role of speech in integrating different aspects of development Vygotsky's theory might hold that bilingualism introduces a qualitatively different mode of cognition and restructures the entire mental life of the individual. Piaget would argue, on the other hand, that the bilingual mode of cognition is not qualitatively different from that of the unilingual since all operational thinking derives from action, not language. However, he might allow that an early bilingual environment is especially enriched with respect to one sphere of action - action with words. This early action with words could accelerate the development of operational structures and facilitate the representation of operational thinking through language. In addition to linguistic factors there are also non-linguistic factors in some bilingual learning situations which might accelerate or, in some cases, retard aspects of cognitive development.

This brief comparison of the ways each theory might interpret the effects of bilingualism on cognition must remain speculative since neither Piaget nor Vygotsky nor any of their respective followers has adequately considered the issue.

Summary and Conclusion

The problem in this chapter was to determine whether the Vygotskian and Piagetian positions on the language-thought issue were compatible with the reported effects of bilingualism on cognitive functioning. Vygotsky's theory, with its strong emphasis on the influence of language in cognitive development, would clearly predict differences in cognitive functioning between bilinguals and unilinguals. Piaget's theory, on the other hand, seemed less obviously compatible with the reported results. In fact, Macnamara (1970) argued that because of the strong evidence in favour of Piaget's theory one should expect no differences in the cognitive functioning of bilinguals and unilinguals.

It was argued that Piaget's theory was compatible with the research results, firstly, because there are aspects of the bilingual learning situation (e.g. increased social interaction) which could affect cognitive development in ways which are not directly mediated by language. In other words, linguistic aspects of bilingualism (i.e. deriving directly from the bilingual's access to two verbal codes) are not the only explanatory factors operative in the bilingual learning situation. Secondly, the influence accorded to language in the Piagetian theory is compatible with the specifically linguistic effects of bilingualism. The linguistic explanation which is best substantiated by the empirical research is based on Leopold's (1949) observation that the bilingual child's attention is directed to the essential attributes of objects by the fact that he has two words for the same referent. This capacity of language to focus the child's attention on different features of the object is precisely the aspect of language which Piaget emphasizes in relation to cognitive development.

Thus, Piaget's theory has no difficulty in accounting for the effects of bilingualism on cognitive functioning. The distinction between the two fundamentally different ways in which bilingualism might affect cognitive processes should make possible the development of a more adequate theoretical context for the study of bilingualism and cognition than has existed hitherto.

CHAPTER 5

BILINGUALISM AND COGNITIVE REPRESENTATION

In the previous chapter two qualitatively different ways - "linguistic" and "non-linguistic" - in which bilingualism might affect cognitive growth were distinguished. The use of the term "linguistic" should not be taken to indicate that the effects of bilingualism are confined to the linguistic medium. Rather, what is meant is that bilingualism will affect imagistic representation and concept formation, if it does affect these processes, through its primary influence on the verbal symbol system of the individual. The use of the term "non-linguistic" is meant to signify the fact that bilingualism can also influence cognitive processes in ways which are not directly mediated by the person's verbal symbol system.

This chapter will attempt to describe some of the possible ways in which bilingualism as a "linguistic" variable might affect the individual's use of linguistic and imagistic symbol systems on the one hand, and his operational intelligence on the other.

Bilingualism and the Linguistic System

It should be remembered that we are here only concerned with genuine or balanced bilingualism i.e. when the individual has more or less equal access to both languages. Many of the earlier studies which reported that bilingualism leads to a "language handicap" used subjects whose proficiency in one language was much inferior to that in the other. If many of the interactions of these subjects with the environment (including I.Q tests) have to be conducted through their weaker language, then these individuals are undoubtedly suffering from a "language handicap" but this should not be attributed to bilingualism. On the contrary, it seems justified to argue that their language handicap is precisely their lack of bilingualism. Thus, arguments concerning the effects of instruction in a weaker language and the "balance effect" (Macnamara, 1966), while undoubtedly very relevant to bilingual education programs, are not of direct import to this section. The problem here is to examine what effects access to two language systems will have on the facility with which a person uses linguistic symbols in his thinking processes.

In contrast to the many early studies which proposed the "language handicap" hypothesis, several more recent investigations have suggested that balanced bilingualism has a facilitating effect at the level of the linguistic symbol system. Peal and Lambert (1962) suggest that since there is considerable overlap between French and English vocabularies, the bilingual student may be helped when functioning in either language by positive transfer from the other. Similarily, Lambert and Tucker (1972) argue that the process of comparing languages "immeasurably" helps the bilingual child "to build vocabulary and to comprehend complex linguistic functions (1972, p. 208)." The ramifications of this linguistic facilitation for conceptual functioning will be considered later. Suffice it to say that the effects are likely to be significant since vocabulary tests are typically the best predictors of overall intelligence and a high level of linguistic competence will undoubtedly help in the expression of and ability to use one's intelligence.

Bilingualism and the Imagistic System

Virtually no empirical research has been done on the question of how bilingualism affects imagistic representation. Vildomec (1963) reports that most of the multilingual individuals in his survey tended to be "visualizers" (p. 184). However, this report is of doubtful value since it is based only on subjects' reports that they remembered better what they read than what they heard. Vera John (1970) argues that bilingual children are often "caught between two languages" in the early school years and therefore the instructional use of imagery may be of great assistance to them since they need special help in organizing their world. She points out that the role of "visual conceptualization" in the bilingual is of special interest but fails to elaborate further on this point.

Vera John's hypothesis seems more likely to be valid for "pseudo-bilinguals" (i.e. those who have not achieved balance between their two languages) than for genuine or balanced bilinguals. However, it is an interesting theoretical possibility and worth investigating both with balanced and unbalanced bilinguals.

Another way in which bilingualism could conceivably affect imagistic representation should be mentioned. Leopold (1949) and Ianco-Worrall (1972) offer evidence that the use of two verbal codes by the bilingual child might lead to quicker abstraction of the conceptual features of the object. In a similar vein, except at the imagistic rather than the conceptual level, one could hypothesize that having two words for the same referent draws the bilingual's attention to the non-linguistic features of the object itself, and this expresses itself at the level of symbols by a tendency to think more in images than in words. Despite these theoretical possibilities, there is as yet no empirical research into how bilingualism might affect imagistic representation.

Bilingualism and Operational Intelligence

Several of the studies that have been reviewed have reported that bilingualism leads to higher levels of concept formation and non-verbal intelligence (Lideke and Nelson, 1968, Peal and Lambert, 1962). Only one of the attempts to explain these results has involved a "linguistic" explanation i.e. Peal and Lambert's (1962) hypothesis that the faster separation of sound and referent in the bilingual child leads to quicker abstraction of the conceptual features of the object. Peal and Lambert use this hypothesis to explain the superior performance of their bilingual group on measures of general reasoning.

Several authors have hypothesized that the bilingual child will compare and contrast his two languages. Although the question has not been explicitely investigated, it seems likely that this "action with words" could accelerate the development of operational structures. Bruner (1966), for example, argues that the capacity for symbolic representation is marked by the child's ability to use the built-in properties of language (e.g. categories and hierarchical organization) in his thinking. However, before this can happen his experience must be brought into conformity with principles which are in some degree ismorphic with the structural principles of syntax. The bilingual child's development is likely to be faster than the unilingual's in this regard since his attention will of necessity be drawn to the "built-in properties of language" by the fact that his two languages express things in different ways. In the previous chapter it was shown that such an acceleration of operational development was consistent with the theories of Piaget and Vygotsky.

In addition to these "linguistic" ways, there are also "non-linguistic" ways (e.g. greater social interaction in the bilingual learning situation, greater cultural stimulation) in which bilingualism might affect operational development.

This survey of the ways in which bilingualism might be theoretically expected to affect verbal and imagistic symbolic habits on the one hand, and operational intelligence on the other, is intended as an introduction to the empirical study which investigated the effects of bilingualism on these processes. We turn now to the empirical investigation itself.

Chapter 6

RESEARCH DESIGN AND METHODOLOGY

It has been shown by Guilford (1967) among others that both imagery and verbal processes are involved in many different types of cognitive abilities; thus, it was decided to investigate the influence of bilingualism on symbolic habits in several areas of cognitive functioning - specifically, memory, reasoning, and divergent thinking. The basic design of the study is shown in Figure 1.

The tests which were administered were designed to tap both verbal and imagistic or spatial processes in the areas of memory, reasoning and divergent thinking.

Objectives

The major objectives of the study were: firstly, to investigate whether there are any significant differences between bilinguals and unilinguals in memory, reasoning and divergent thinking abilities; and secondly, to investigate whether bilingualism leads to a tendency to think more in terms of images as opposed to linguistic symbols or vice-versa.

Other objectives were

1. to investigate cognitive differences between balanced bilinguals and those who had not achieved balance between their two languages.
2. to investigate whether there were any significant

	Memory	Reasoning	Divergence
Verbal			
Spatial			

Figure 1. Basic Research Design

5

differences, both on the cognitive variables and on measures of linguistic balance, between children from French, English and mixed (i.e. both French and English spoken at home) home backgrounds.

Subjects

Bilingual and unilingual samples: The bilingual sample was drawn from the French-English bilingual program of the Separate School System in Edmonton, Canada. Three grade 6 classes from three different schools were tested. Three students were excluded from consideration for the balanced bilingual sample because of knowledge of a third language (other than French or English), and from the remainder (82 subjects) a group of 61 subjects was selected on the basis of three measures of linguistic balance (see Appendix E). Thus, the final bilingual sample consisted entirely of balanced bilinguals.

The unilingual group was drawn from two schools in the Edmonton Public School System. 89 students from three classes were tested. A questionnaire was administered to determine whether the children had any knowledge of a language other than English and on this basis 18 students were excluded from the sample (see Appendix D). From the remaining 71 students a sample of 61 was matched with the bilingual group on the bases of sex, social class (SES) and age.

Both bilingual (B) and unilingual (U) groups consisted of 32 girls and 29 boys; their SES indices (Blishen 7-point scale) were 3.59 (B) and 3.60 (U) and their mean ages were 11 years 6 months (B) and 11 years 7 months (U).

Linguistic backgrounds of the bilingual group: The children were also administered a questionnaire (see Appendix D) which asked which language they spoke at home, which language their parents spoke at home and which language they spoke with their friends. On the basis of the language or languages spoken at home by their parents the children were divided into homes where both parents spoke English, homes where the parents spoke French and homes where the parents spoke both French and English.[1] The composition of the balanced bilingual group in terms of home background was as follows: French 25 (out of a possible 29), Mixed 24 (out of 30), English 12 (out of 23).

The bilingual curriculum: The percentage of time that the bilingual children spent learning through the medium of French varied somewhat between schools and between grades. The bilingual schools have been working towards 50% of the time in French but are hampered in this aim by lack of suitable materials for some subjects. Social science, physical education, music, art and recently some mathematics have been taught through French.

In terms of Mackey's (1971) typology of bilingual education, the curriculum pattern of the three bilingual schools in the present study would be classified as Dual-Medium Differential Maintenance (DDM). The bilingual learning situation would be classified as DDM 6 (see Mackey 1971, p. 171).

Possible sources of contamination of the bilingual sample: The most obvious limitation of the bilingual sample is that, by grade 6, children who are not capable of benefiting from the bilingual program are likely to have dropped out and thus the possible negative effects of bilingual schooling on some children would not appear in the results of the present study.

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[1] No data were collected on the exact pattern of mixed linguistic usage. Thus, we do not know precisely how much of each language is spoken, or whether both parents speak both languages to the child.

The second possible source of contamination concerns the extent to which the bilingual learning situation has been isolated. It might be argued that parents who send their children to a bilingual school are more culturally aware than those who send their children to a unilingual school and this factor is not necessarily controlled by matching the two groups on SES. In other words, the very fact that a parent sends his child to a bilingual school is an indication that he is aware of the cultural value of a second language and possibly that the cultural level of his home is higher than one might predict from his SES level. Here it is necessary to distinguish between cultural stimulation which is intrinsic to the notion of "bilinguity" and the cultural stimulation mentioned above which, if it exists, is extraneous to the bilingual situation and represents a possible source of contamination. The cultural stimulation which derives from exposure to two different cultures is a "non-linguistic" factor which is an intrinsic aspect of the bilingual learning situation. The cultural stimulation which derives from the fact that parents who are more culturally aware might tend to send their children to a bilingual school is extraneous to the bilingual learning situation.

In the present study this factor appears most likely to operate among the English homebackground group since the other two groups are likely to have been exposed to two languages (and may even be balanced bilinguals) before going to school. However, if this is the case the SES index would have controlled this factor to a large extent since the SES index for the English group is 2.78, for the Mixed group 3.33 and for the French group 4.00.

Materials

Each class was tested on two occasions lasting approximately one hour each. In the first session three subjects of the Kuhlmann-Finch Intelligence Test and a verbal test of divergence were administered. The second session consisted of an adaptation of the Wallach-Kogan (1965) "Patterns" test and four memory tests designed to tap visual and verbal mediation processes in memory. The balance measures were administered to the bilingual classes during the first session.

Before considering the balance measures themselves, it should be emphasized that "balance" does not imply equilinguality. The balance measures were used in the present study to assess the relative fluency in English and French of the children in the bilingual program and to eliminate those who were much more dominant in one of their two languages.

Balance measures: (a) Word Association Test: This test was similar to the word association test used by Peal and Lambert (1962). The children were asked to write down as many words as they could think of, in the language of the stimulus word, which seemed to "go with" or "belong with" that word. An interval of 60 seconds was allowed for association to each word. The balance score was calculated as follows:

$$\frac{(\text{Sum of English words}) - (\text{Sum of French words})}{(\text{Sum of English words}) + (\text{Sum of French words})} \times 100$$

A zero indicates perfect balance between the two languages.

(b) Subjective Self-Rating: The bilingual subjects were asked to rate their ability to speak, read, write and understand English and French on 4 point scales ranging from "not at all" to "very well". 4 points were given for a "very well" response and 1 point for a "not at all" response, so that the maximum score for each language was 16. The ratio of the English and French self-ratings was used to form a balance score.

(c) Teacher Rating: The third measure of balance was the teacher's ratings of the child's relative competence in English and French. The teacher was asked whether the child benefited "much more", "somewhat more" or "equally" from instruction in either language.

The self-rating scores and teachers' ratings were transferred to the same scale as the word association test and a composite balance score was formed by combining the three measures. The criterion for inclusion in the balanced groups was a composite score of between ±25.

The self-rating scores were rescaled by the following method:

$$\frac{100}{1} - \frac{\text{French score} \times 100}{\text{English score}}$$

A positive score indicates greater proficiency in English and a negative score greater proficiency in French. To reach the balance level (between ±25) a score of 12 out of 16 was required.

The teachers' ratings were rescaled as follows: a rating of "much more" was scored 50, "somewhat more" 25 and "equally" zero. Although the 3 point scale is somewhat crude, it is doubtful if much more validity would have been gained from, for example, a 5 point scale. The teacher ratings correlate significantly higher with the other two balance measures than they do with each other (see Table 2, p. 61).

No one balance measure was sufficient to exclude an individual from the balanced group. An individual could score above ±25 on one of the measures and compensate on the other two so that his composite score was under ±25. Although comparison cannot be exact due to differences in tests and procedures, the criterion of ±25 seems at least as stringent as that employed by Peal and Lambert (1962). For example, Peal and Lambert's criterion of balance in the Word Association Test is ±30. The intercorrelations of the balance measures are shown in Table 2.

Macnamara (1966) has criticised Peal and Lambert's (1962) study on the grounds that their use of tests of linguistic balance invalidates the comparison of bilinguals and unilinguals on verbal intelligence measures. He says that perhaps only the more linguistically gifted French-Canadian children were capable of acquiring, by age 10, a command of English equal to their command of French. If so, comparisons in linguistic performance between the balanced bilinguals and unilinguals were biased in favour of the former. A similar argument could be made in the case of the present study. It could be argued that only the more linguistically gifted of the English home background group are capable of becoming balanced bilinguals. However, the available data from the present study offer no support for such an argument. The correlations of the balance measures with the test of verbal intelligence (KF 1) for the total bilingual group (82 subjects) and for the three home background groups are shown in Table 3. The only significant correlations for the E group are with the two English balance measures. Thus, it can hardly be argued that performance on the French balance measures is a predictor of verbal intelligence.

A comparison of the performance of balanced and unbalanced members of the English home background group on KF 1 again shows no relationship between balance and verbal ability. An analysis of covariance with SES as covariate showed that the adjusted mean of the balanced English group ($N = 12$) on KF 1 was 17.01. The unbalanced mean ($N=11$) was 17.17. The probability level was $p<.92$.

One can conclude, therefore, that the comparison of bilinguals and unilinguals on the verbal intelligence measures has not been invalidated by the selection of only balanced bilinguals.

Memory tests: Two verbal Free Recall (FR) and two verbal Paired-associate (PA) tests were administered. One list in both the FR and PA tests consisted of concrete words and the other of abstract words. Paivio (1969, 1971) and his colleagues at the University of Western Ontario have demonstrated that PA lists consisting of concrete words are remembered by means of imagistic mediation, whereas abstract words are much less potent in their capacity to arouse images and tend to be remembered through verbal mediation. The PA abstract and concrete lists each consisted of 8 pairs and were equated for

TABLE 2

Intercorrelations of Balance Measures

Measure	1.	2.	3.	4.
1. Word Association (Ratio 1)	1.000	.290	.523	.706
2. Self-rating (Ratio 2)		1.000	.488	.741
3. Teacher rating			1.000	.895
4. Composite				1.000

.280 is significant at p<.01

TABLE 3

Correlations between the Balance Measures and Verbal Intelligence (KF 1)

Variable	English (N=23)	French (N=29)	Mixed M (N=30)	Total Group (N=82)
1. English Word Association	.398*	.358*	.086	.273*
2. French Word Association	.183	.114	.241	.045
3. English Self-Rating	.527**	.302	-.095	.320**
4. French Self-Rating	.004	.107	.069	-.119
5. Ratio 1	.247	-.171	-.224	.089
6. Ratio 2	.292	-.289	-.105	.015
7. Teacher Ratio	.216	-.271	-.697**	-.132

* p<.05
** p<.01

meaningfulness and varied in image-evoking value according to the values given by Paivio, Yuille & Madigan (1968). The PA lists were played twice on tape while the lists were being projected on the screen. The projection was removed 15 seconds after the second reading of the list and the stimulus words played on tape with 10 second intervals for S's to write in the appropriate response words. The instructions for both the PA tasks were the same. (The full instructions are given in Appendix C).

The FR lists each consisted of 16 words and were varied in image-evoking value. Both lists were played back once on tape and projected for two minutes. In FR with concrete words the following instructions were given, "In learning the words it might help you if you try to imagine the object in your head. For example, if one of the words was 'chair' you could picture a chair in your head." FR with abstract words consisted of four groups of words which were conceptually related to one another e.g. one group consisted of 'yard', 'distance', 'mile' and 'length'. The order of presentation of the 16 words was random. The following instructions were given, "In this test some of the words are connected to each other in various ways. You might find it easier to learn the words if you looked for the connections between them or the ways in which some of the words go together." The full instructions and test items are given in Appendix C.

Thus, in both the PA and FR tasks the image-evoking value of the items and the instructions were systematically varied in such a way as to differentially elicit verbal and imagistic mediation processes.

Reasoning tests: Three subtests of the Kuhlmann-Finch Intelligence Test designed to measure verbal and spatial abilities and general reasoning (subtests 1, 2 and 4) were administered. The Kuhlmann-Finch manual (1956 pp. 50-56) presents satisfactory evidence of the reliability and validity of these measures. The Spearman-Brown split half reliability for the grade 6 test is .92. The three subtests used in the present study are shown in Appendix A.

In addition, the Lorge-Thorndike I.Q. from the school records was included in the analysis.

Divergent thinking tests: The "Utility Test" from the French, Ekstrom and Price (1963) Kit of Reference Tests for Cognitive Factors was administered as a measure of verbal divergence. The "Utility Test" asks subjects to list as many uses as they can think of for two common objects - "pencil" and "brick". Six minutes were given for response to each word and the children were instructed to try and think of uses that nobody else would think of. A game-like "fun" atmosphere was encouraged. The "Utility Test" is derived from one originally devised by Guilford (1967) in her factor analytic work on cognitive abilities.

Wallach and Kogan's (1965) "Patterns Test" (adapted for group administration) was administered as a measure of non-verbal divergence. This test consists of a series of 8 "meaningless" line drawings and the child was required to list as many things as he could think of that each drawing might represent. The test was called the "What Is It

Game" and children were told to work at their own pace. Most children had completed the test within 20 minutes. The Spearman-Brown split half reliability coefficients for this test, as reported by Wallach and Kogan (1965), were .88 for uniqueness of response and .93 for number of responses. Thus, this test possesses a high degree of internal consistency.

The "Utility Test" was scored for fluency (number of uses listed), flexibility (extent to which the class of uses is shifted) and originality (uniqueness of response). The scoring of performance in terms of fluency, flexibility and originality corresponds to three different divergent production abilities in Guilford's (1967) model, i.e. divergent production of semantic units (DMU), divergent production of semantic classes (DMC) and divergent production of semantic transformations (DMT).

The figural "Patterns Test" was scored for fluency and originality. The originality score was calculated in the following manner for both Patterns and Utility tests. Any response which occurred between 2 and 6 times inclusive (out of the total sample of 171 subjects) was credited with 2 points and any unique response (occurs only once in the entire sample) was credited with 5 points. The technique follows that of Taylor (1971) and represents a compromise between the rather complex weighting system suggested by Cropley (1967, p. 53) and the lack of any weighting in the Wallach-Kogan (1965) scoring procedure.

How valid are measures of divergent thinking? If, as is usually the case, one regards these tests as tests of "creativity" then, as Macnamara (1970, p. 36) points out, there is a "total absence of any indications of validity for measures of creativity in school children." In other words, what divergent thinking tests measure should not be uncritically labelled "creativity". No consistent relationships have been shown between performance on these tests and creativity in real life. All that can be said is that these tests measure an ability which is partially independent of "g" and that the type of cognitive processes which they measure have been hypothesized to be important in creative thinking. For the purposes of this research these tests are regarded as measuring a well-established cognitive ability (Wallach and Kogan, 1965; Guilford, 1967 etc.) whose precise relationship to creative functioning is still largely unresolved. The divergent thinking tests and instructions are shown in Appendix B.

Chapter 7

RESULTS

A. Comparision of Performance of Bilingual and Unilingual Groups

The performance of the matched bilingual and unilingual groups on the cognitive measures was analysed by means of a one-way analysis of variance. The means, standard deviations, F values and probability levels are shown in Table 4.

The bilingual group performed significantly better than the unilingual group on the verbal ability and general reasoning subtests and also on the measure of originality in the verbal test of divergence. The unilinguals performed significantly better on one of the memory tests - Free Recall with abstract words.

Possibly due both to factors connected to the group testing situation and the fact that abstract and concrete lists were presented both visually and aurally, the methods of remembering the abstract and concrete lists did not appear to differ. Both type of lists show a similar pattern of inter-correlations with the other variables and the impression gained while administering the tests was that the lists tended to be learned by rote rather than through any form of mediation.

B. Comparision of Performance of Balanced and Unbalanced Bilinguals

As there were large SES differences between the balanced (B) and unbalanced (Ub) groups (B - 3.59, Ub - 2.90, $p<.11$) a one-way analysis of covariance was carried out with SES as covariate. The adjusted means, standard deviations, adjusted F values and probability levels are shown in Table 5.

A similar pattern of results is evident in the comparison of balanced and unbalanced bilinguals as in the comparison of balanced bilinguals and unilinguals. There are significant differences between the groups on general reasoning and the three verbal divergence measures. In addition, the balanced group scores higher on all the verbal tests while the unbalanced group scores higher on the spatial ability measure, and the differences between the groups on the Patterns test are very much less than the differences on the verbal measures of divergence. Thus, there is again some evidence of facilitation of verbal processing among the balanced bilinguals.

C. Comparison of Children from Different Home Backgrounds

The home background data were analysed by means of a one-way analysis of variance. The means, F values and probability levels for children from French (F), English (E) and mixed French and English (M) home backgrounds are shown in Table 6. As there were significant differences between the groups on SES a one-way analysis of covariance was performed on the variables where sizable differences were found between groups (i.e. balance and intelligence measures). This analysis is shown in Table 7.

The results in Tables 6 and 7 are quite clear. There are highly significant differences between the groups in the level of balance achieved between English and French. The F group are most balanced, the M group next and the E group least balanced. The mean

TABLE 4

Means, Standard Deviations, F Values and Probability Levels for Bilingual and Unilingual Groups

Variable	Bilingual (N=61)		Unilingual (N=61)		F Value[1]	Probability Level
	M	S.D.	M	S.D.		
1. Kuhlman-Finch (KF) 1 (verbal ability)	15.90	3.8	14.11	5.0	4.59	.03 *
2. KF 2 (verbal ability)	10.36	4.4	11.34	4.4	-1.54	.22
3. KF 4 (general reasoning)	15.62	3.7	14.08	4.9	3.90	.05 *
4. Lorge-Thorndike I.Q. percentile	65.93	23.0	64.98	26.9	.04	.83
5. Utility Fluency	19.95	6.1	20.75	6.8	-.47	.49
6. Utility Flexibility	13.67	6.1	12.57	5.7	1.05	.30
7. Utility Originality	11.44	8.7	7.13	5.2	10.98	.001 ***
8. Patterns Fluency	23.80	11.5	25.20	10.8	-.36	.54
9. Patterns Originality	21.39	12.6	18.89	13.0	1.08	.30
10. FR concrete	11.72	2.3	11.93	2.6	-.23	.63
11. FR abstract	10.15	2.7	11.11	2.4	-4.38	.04 *
12. PA concrete	6.48	1.7	6.97	1.[illegible]	-3.29	.07
13. PA abstract	5.39	1.7	5.43	1.7	-.01	.92
14. SES	3.59	1.7	3.60	1.8	.00	.96

[1] Positive entries indicate that the mean for the bilingual group is higher than the mean for the unilingual group. Negative entries indicate the reverse.

TABLE 5

Adjusted Means, Standard Deviations, F Values, and Probability Levels for Balanced and Unbalanced Groups with SES as Covariate

	Balanced (N=61)		Unbalanced (N=21)		F Value	Probability Level
	M	S.D.	M	S.D.		
1. KF 1 (verbal ability)	16,03	3.8	14.89	4.3	1.44	.23
2. KF 2 (spatial ability)	10,48	4.4	11.07	5.0	-.27	.61
3. KF 4 (general reasoning)	15.68	3.7	13.31	5.8	4.62	.04 *
4. L-T I.Q. percentile	66.75	23.0	59.92	23.3	1.47	.23
5. Utility fluency	19.99	6.1	16.78	4.8	4.65	.03 *
6. Utility flexibility	13,80	6.1	9.16	4.3	10.39	.002 **
7. Utility originality	11,82	8.7	5.91	6.8	9.26	.003 **
8. Patterns fluency	23,93	11.5	22.40	7.9	.31	.58
9. Patterns originality	21.85	12.6	20.09	18.2	.25	.62
10. FR concrete	11,79	2.3	11.18	2.2	1.10	.29
11. FR abstract	10.24	2.7	9.94	2.6	.21	.65
12. PA concrete	6.51	1.7	5.81	2.1	2.36	.13
13. PA abstract	5.46	1.7	4.72	2.2	2.61	.11

TABLE 6

Analysis of Variance for Children from English, French and Mixed Home Backgrounds

Variable	English M (N=23)	French M (N=29)	Mixed M (N=30)	F value	Probability
1. E word association	30.30	29.00	30.50	.21	.81
2. F word association	17.87	24.93	21.67	4.86	.01 **
3. E self rating	15.52	14.55	15.40	3.54	.03 *
4. F self rating	11.74	14.24	12.73	14.60	.000004 ***
5. Ratio 1	25.83	1[illegible].45	17.35	7.81	.0008 ***
6. Ratio 2	24.09	12.59	17.27	4.89	.009 **
7. Teacher Rating	29.57	11.00	14.77	7.61	.0009 ***
8. Balance Composite	26.30	11.86	15.83	11.54	.000004 ***
9. KF 1	17.09	14.03	16.37	4.99	.009 **
10. KF 2	10.70	9.66	11.53	1.27	.29
11. KF 4	14.39	14.31	16.33	2.01	.14
12. LT I.Q. percentile	72.35	58.66	65.50	2.36	.10
13. Utility fluency	19.43	20.00	18.17	.74	.47
14. Utility flexibility	12.91	11.83	13.13	.39	.67
15. Utility originality	10.35	9.62	10.93	.17	.84
16. Patterns fluency	24.09	22.90	23.73	.09	.91
17. Patterns originality	25.52	19.00	20.57	1.47	.24
18. FR CW	12.43	11.34	11.30	2.04	.14
19. FR AW	10.87	9.93	9.83	1.17	.31
20. PA CW	6.83	6.21	6.07	1.26	.29
21. PA AW	5.74	4.83	5.33	1.57	.21
22. SES	2.78	4.00	3.33	3.69	.03 *

TABLE 7

Analysis of Covariance for Children from English, French and Mixed Home Backgrounds with SES as Covariate

Variable	English adj. M	French adj. M	Mixed adj. M	F value	Probability
1. Ratio 1	25.20	13.03	17.29	6.00	.004 **
2. Ratio 2	24.36	12.33	17.30	4.85	.01 **
3. Teacher ratio	29.65	10.93	14.78	7.08	.001 ***
4. Balance composite	26.21	11.95	15.82	10.27	.00004 ***
5. KF 1	16.74	14.36	16.32	3.10	.05 *
6. KF 2	10.26	10.06	11.48	.87	.42
7. KF 4	14.26	14.43	16.32	1.95	.15
8. LT I.Q. percentile	70.02	60.81	65.20	1.03	.36

of the E group on the composite score fails to meet the criterion of balance used in the present study (between ±25).

The clarity with which the balance measures discriminated between the three groups and the almost perfect agreement between them is an indication of their validity. The balance scores of the three groups have several implications for bilingual schooling (in a setting such as Edmonton) and these will be considered in the next chapter.

The only significant difference on the intelligence measures was on KF 1 - verbal ability. The E group performs best, M next and F worst on this measure. The analysis of variance shows a significance level of $p<.009$ but when the groups are statistically matched on SES this is reduced to $p<.05$. In the second analysis the differences between the E and M groups is negligable but the mean of the F group, despite being matched for SES with the other groups, is still significantly lower than that of the other groups. It seems likely then that the inferior performance of the F group on the verbal intelligence measure can be attributed to a linguistic factor i.e. to their language learning experiences.

CHAPTER 8

DISCUSSION

Bilingualism and Operational Intelligence

The results of the present study are remarkably consistent with the results of the Peal and Lambert (1962) study and with trends which have emerged from more recent studies. An examination of the research results shown in Table 1 (page 19) reveals two major trends. The first is a tendency for bilinguals to perform better on measures of concept formation or general reasoning. The second, and more surprising tendency in view of the results of studies prior to Peal and Lambert (1962) is for bilinguals to show superior verbal ability. Both these trends are confirmed in the present study. Thus, the results of this study add to the evidence that bilingualism accelerates some aspects of development related to the growth of operational intelligence.

The study does not give any basis for choosing between the explanations of this phenomenon suggested by previous investigators (see Table 1, page 19). Several of these explanations, both "linguistic" and "non-linguistic" seem adequate to account for the results and it is likely that the bilinguals' superior performance is the result of several factors working together. In addition, different explanatory factors are likely to be operating in the case of bilinguals from different home backgrounds since the language learning situations of each of these three groups differ markedly.

In summary, the writer is inclined to emphasize the variety of possible explanatory influences which are working together in bilingual learning situations rather than emphasizing one explanatory factor to the exclusion of all others.

Verbal and Imagistic Processes in Bilinguals

A major objective of the present study was to investigate whether there was any tendency for the bilinguals to rely more on imagistic as opposed to verbal processing in comparison with the unilinguals. Although the differences do not reach significance, the unilinguals score higher on the spatial ability and Patterns fluency, but not originality, measures, whereas there are significant differences in favour of the bilinguals on the verbal ability and verbal originality measures. This suggests that the bilinguals, rather than relying more on imagistic representation as Vera John (1970) speculated they might, are more adept at verbal processing.

It seems likely that John's (1970) hypothesis had its roots in the early studies of bilingualism (i.e. pre-Peal and Lambert (1962)) which suggested that bilinguals suffered from a "language handicap". However, in view of more recent studies which suggest that bilingualism might engender some type of "linguistic enrichment" rather than a "language handicap" it is not surprising that no differences were found between bilinguals and unilinguals on the imagistic tasks. The present results add to the evidence (see Table 1) that some types of bilingualism facilitate verbal information processing. This does not mean of course that in a different bilingual learning situation, where a different constellation of variables is operative, bilinguals might not suffer from "linguistic confusion" and possibly rely more on imagistic processing.

The interpretation that some types of bilingualism facilitate verbal processing must remain tentative in view of the fact that the memory tests did not appear to measure verbal and imagistic mediation processes. This is probably due to the fact that the group testing situation was conducive to little but rote memory (once one child started rattling off the words in a loud whisper it was difficult for others not to follow suit). A follow-up study of mediation processes in bilingual memory, under more controlled conditions, is necessary to answer the question of whether the facilitation of verbal processing observed for some types of bilinguals is generalizable to all areas of cognitive functioning.

Rigidity and Flexibility in Bilinguals

Balkan's (1970) study provides empirical evidence that balanced bilinguals are more cognitively flexible than unilinguals. There has also been speculation (Peal and Lambert, 1962; Landry, 1974) that the habitual switching of languages might lead to a greater degree of cognitive flexibility in the bilingual. It was pointed out, however, that it was unclear how "cognitive flexibility" was related to constructs such as "attitudinal flexibility" (Gardner and Lambert, 1972) and divergent thinking or creativity.

The present study has shown that balanced bilinguals performed significantly better than unilinguals on a verbal originality measure. In addition, the balanced bilingual group performed at a higher level than the unbalanced group on all three measures of verbal divergence i.e. fluency, flexibility and originality. These results provide some evidence that balanced bilingualism might facilitate divergent thinking. However, in interpreting the results it should be remembered that differences between bilinguals and unilinguals on the other divergence measures did not reach significance.

The explanation which seems most appropriate to account for these results is the "switching" hypothesis (Peal and Lambert, 1962; Balkan, 1970). A characteristic of balanced bilingualism is the capacity to switch freely between languages and it is therefore noteworthy that the differences between the balanced and unbalanced bilingual groups on the verbal divergence measures were highly significant.

It should be noted that although Peal and Lambert (1962) and Balkan (1970) use the "switching" hypothesis to account for their results, the performances which they attempt to explain by means of this hypothesis are very different both from each other and from the performance on the divergent thinking tasks used in the present study. However, it might be argued that bilingualism generates "une souplesse d'esprit" which affects the entire mental life (attitudinal and cognitive) of the bilingual. Although such an effect is theoretically possible it does not constitute an explanation of the differences between bilinguals and unilinguals on various measures of performance. It is still necessary to explain how bilingualism affects different kinds of mental process, and it is unlikely that one general explanatory factor is adequate to account for all the differences in performance between bilinguals and unilinguals. For example, the bilingual's experiences in two cultures seems a more appropriate explanation for his greater degree of attitudinal flexibility than the "language switching" hypothesis, whereas the opposite is true for the bilingual's cognitive flexibility. The assertion that different explanatory factors are appropriate to account for the attitudinal and cognitive flexibility of the bilingual is supported by Stewin's (1968) study which found no relationship between attitudinal rigidity and rigidity as measured by the Vygotsky blocks task.

Implications for Bilingual Education

While the implications are, in general, encouraging in that they indicate that bilinguals who are capable of achieving balance between their two languages perform better than unilinguals on certain kinds of cognitive tasks, there are some reservations. In the first place, by grade 6 most children who are not capable of benefiting from the bilingual program are likely to have dropped out and thus the possible negative effects of bilingual schooling on some children would not appear in the results of the present study.

Also, the results of the home background analysis indicate that bilingual schooling has different effects on children from different home backgrounds. In the first place, it is apparent that six years of bilingual schooling have not led to a high degree of balance among the English home background group. Their mean score on the composite balance measure was higher than the criterion of balance accepted for the present study (between ± 25) and 11 (out of 23) of the English group were excluded from the balanced sample. There are significant differences between this group and the other home background groups on all the balance measures. Thus, one can conclude that in an English speaking community such as Edmonton, school experiences alone are not sufficient to develop in the child from an English speaking home background a level of balance equal to that of the mixed or French home background groups. However, when one considers the fact that the only opportunity the English child has to use French is in the classroom (since English is the language of the playground), his level of competence in French seems much more impressive, and his level of balance far beyond what might be achieved in the usual French program.

Another significant factor is that no cognitive deficits are apparent even though much of his schooling has been through a weaker language. In fact, six years of bilingual schooling seems to have conferred definite cognitive advantages on the English home background child. His high score on the verbal ability measure adds weight to Lambert and Tucker's (1972) assertion (in relation to a similar group) that the comparison of languages helps children "immeasurably to build vocabulary and to comprehend complex linguistic functions (1972, p. 208)."

Thus, the effects of bilingual schooling on the English group seem encouraging. The results for this group, supported by the data of the St. Lambert project in Montreal, seem to indicate that with relatively intelligent, relatively high SES children, teaching through the medium of the child's weaker language need have no negative cognitive effects and is likely even to be a cognitively enriching experience.

The situation of the mixed group is similar. Their scores on the English balance measures (English word association and English self-rating) are as high as those of the English group, and their scores on the French balance measures only slightly lower than those of the French group. The type of bilingual program in the schools tested, i.e. Dual-medium Maintenance as classified by Mackey (1971), seems especially suitable for these children since they are likely to have been reasonably fluent in both languages before coming to school and both languages are spoken in the home.

On the intelligence measures the cognitive advantages of the mixed group in relation to the unilinguals is most marked. On the verbal intelligence measure they perform as well as the English group (see Table 7) and better than the French group. This indicates that the mixed group, who have had bilingual experience in the home, are as proficient in linguistic reasoning involving L_1 (English) as those whose early upbringing has been totally through the medium of L_1, and at a definite advantage over those whose early experience has been in a minority language (L_2). The mixed group also performs better than either of the other groups on the measure of general reasoning ($p < .15$) and their score is also slightly higher on the spatial ability measure. These results seem to indicate that the children from the mixed home background have more of a cognitive advantage (as compared to the unilinguals) than either of the other two groups.

The most interesting aspect of the results of the French group is the apparent contradiction that exists between the "surface" fluency of the French group in English (as measured by the balance measures) and their inferior performance on the verbal intelligence measure. The balance scores of the French home background group showed slight English dominance but their inferior showing on the verbal intelligence measure indicates that this surface competence might not have fully penetrated to the conceptual level. Since the French group perform as well as the English group on the spatial ability and general reasoning measures (see Table 7), they are obviously not suffering from a general intellectual handicap. However, the data indicate clearly that they do experience difficulty (in comparison to the other bilingual groups) in functioning at the conceptual level through the medium of English. However, it should be emphasized that the scores on the verbal ability measure of the French group are as high as the scores of the unilingual group. Thus, we are talking not so much in terms of a handicap in verbal reasoning as a lack of enrichment.

Would the French group perform better on a verbal intelligence measure administered in French? This cannot be answered for certain, but there are indications in the present data that they would not. Their French self-rating scores and French word association scores are lower than their English self-rating and word association scores. In other words, their verbal fluency in French is lower than it is in English and they have less confidence in their French linguistic skills than in their English linguistic skills. Both their French and English self-rating scores are significantly lower than the English self-rating scores of the English and mixed groups. Thus, although the French group has developed more skills in English than either of the other two groups have in French (i.e. the French home background children have become more balanced bilinguals), they appear to pay for their increased competence in English by a lowering of their competence in

French.

This result appears to lend some support to Macnamara's (1966) "balance effect" hypothesis i.e. that as a bilingual develops skills in one of his two languages, he pays for it by a decrease in competence in the other.

The performance of the French group on the balance and verbal ability measures raises some doubts as to whether this particular bilingual program is right for them. The French home background children in the present study seem to be caught between two languages as far as verbal reasoning is concerned. One must therefore ask whether it would not be better to differentially emphasize one of the French groups' languages in relation to the other. For example, a school conducted mostly through French would likely not affect the child's conversational fluency in English (since this is largely acquired in the world outside) but might render French a more adequate instrument for representing conceptual processes. On the other hand, more time spent through the medium of English in a conceptually demanding school situation might improve the French child's verbal reasoning abilities in English, which, if the child stays in Edmonton, is the language he will be required to use for most of his daily activities.

This review of the differences between the three home background groups emphasizes the fact that in every bilingual learning situation there are different causal factors operative, and results derived from the investigation of one particular bilingual learning situation cannot be uncritically generalized to any other.

Chapter 9

SUMMARY AND CONCLUSIONS

The primary aim of this thesis has been to clarify the problem of what consequences the acquisition and use of two language systems have for the cognitive functioning of the bilingual. This issue has been examined both by means of theoretical analysis and empirical investigation. This final chapter will attempt to sum up the significance of the study for the field of bilingualism and cognition.

Previous studies tended to investigate only the effects of bilingualism on operational intelligence normally expressed as the influence of bilingualism on I.Q. scores. The novel contribution of the present study is in investigating the effects of bilingualism not only on operational intelligence but also on the symbol systems through which this intelligence is expressed, and also, in developing a theoretical framework in which this problem can be meaningfully examined.

The Theoretical Analysis

Piaget's and Vygotsky's theories of the relationships between language and operational thought were examined and the implications of each theory for the problem of how bilingualism influences cognitive functioning were drawn out.

Piaget's theory that language does not constitute a sufficient condition for the development of operational thought was contrasted with Vygotsky's view that logical thought is made possible through the internalization of speech. Piaget's theory receives strong empirical support from studies of the cognitive abilities of the deaf (Furth, 1966) and from Sinclair-de-Zwart's (1967) studies of differences in linguistic usage between operational and preoperational children.

Vygotsky's theory, with its strong emphasis on the role of language in cognitive development, was clearly compatible with research results which indicated that there were differences in cognitive functioning between bilinguals and unilinguals. Piaget's theory, on the other hand, seemed less obviously compatible with the reported results. In fact, Macnamara (1970) argued that because of the strong evidence in favour of Piaget's theory, no differences in the cognitive functioning of bilinguals and unilinguals should be expected.

It was argued that Piaget's theory was compatible with the research results, firstly, because there are aspects of the bilingual learning situation (e.g. increased social interaction) which could affect cognitive development in ways which are not directly mediated by language. In other words, predictions regarding the influence of bilingualism on thought are not wholly dependant on the way the language-thought issue is resolved. Secondly, the role accorded to language in Piaget's theory is such that differences would be predicted in the cognitive performance of bilinguals and unilinguals. Piaget (1970) emphasizes that language operates to direct the child's attention to relevant aspects of the task situation. It is this very function of language which is the basis of Leopold's (1949) observation that because he has two words for the same referent, the bilingual child's attention is directed to the essential or conceptual features of the object. In other words, the availability of two words for the same referent accelerates the separation of sound and meaning in the child's mind; Peal and Lambert (1962) have hypothesized that this quicker separation leads to faster abstraction of the conceptual features of the object and can account for the higher level of general reasoning which they found in their bilingual group. This line of reasoning is in no way incompatible with Piaget's theory on the role of language in cognitive development.

A distinction was made between "linguistic" and "non-linguistic" explanations. This distinction refers to the two qualitatively different ways in which bilingualism might affect cognitive functioning. "Linguistic" explanations account for the effects of bilingualism on cognition as a direct result of the fact that the bilingual has access to two linguistic systems. "Non-linguistic" explanations attempt to account for the effects of bilingualism on cognition by reference to factors which are extrinsic to, or by-products of the fact that the bilingual has access to two linguistic systems.

The usefulness of this distinction can be seen when it is placed in the context of the rationale underlying most previous studies of bilingualism and cognition. Most studies have assumed that bilingualism will only affect cognitive functioning to the extent that language interacts with the thinking process. This rationale is also implicit in Macnamara's (1970) assertion that because language does not play a crucial role in the development of the basic cognitive structures bilingualism is unlikely to do so either. It can be seen that this rationale ignores the possibility that bilingualism might affect thought processes in ways which are not directly mediated by language.

In conclusion, the novel theoretical contributions of the present study consist in (1) showing that the theories of both Piaget and Vygotsky are equally compatible with the results of studies of bilingualism and cognition; (2) challenging the implicit rationale of previous studies that bilingualism will only affect cognitive functioning in ways which are directly mediated by language.

The Empirical Study

The underlying assumption of the empirical study was that any variation of the linguistic symbol system of the individual (such as that caused by deafness or bilingualism) could, theoretically, have consequences not only for conceptual processes but also for the use of other symbol systems.

There were two major objectives of the empirical study. The first was to reexamine and extend some aspects of Peal and Lambert's (1962) study; specifically, their findings that bilinguals performed at a higher level on tests of both general reasoning and verbal ability. The present study was designed to reexamine these findings and investigate for what types of bilinguals, if any, they hold true. Therefore, the cognitive performance of children from three different types of bilingual background was examined.

The second major objective of the empirical study was to investigate the possible effects of access to, and use of two language systems on the symbolic habits of the individual i.e. on his relative reliance on, and proficiency in verbal as opposed to imagistic processing. To the writer's knowledge this aspect of bilingual cognition has not been examined previously.

The results showed that the bilinguals performed significantly better on three measures, - verbal ability, general reasoning and verbal originality. The unilinguals performed better on free recall with abstract words; however, the validity of the memory tests as measures of verbal and imagistic mediation was called into question (see page 66).

In terms of the first objective the results are remarkably consistent with the Peal and Lambert (1962) results and with trends which have emerged from more recent studies (see Table 1, page 19). The finding that the bilingual group performed significantly better on the measure of verbal originality, although highly significant, must remain tentative in view of the fact that there were no significant differences on any of the other divergence measures.

In terms of the second objective, the findings of significant differences in favour of the bilinguals on the verbal ability and verbal originality measures can be interpreted as supporting the hypothesis that some types of bilingualism have a facilitating effect on linguistic representation.

Conclusion

The results of the present study support the position that bilingualism can have positive effects on diverse aspects of cognitive functioning. However, it is inappropriate to speak of "bilingualism" as though it were a single condition which can account for differences in cognitive performance between all types of bilinguals and unilinguals. Bilingualism can affect cognitive functioning in many different ways, both "linguistic" and "non-linguistic", and different explanatory factors are operating in the case of children who have been exposed to different bilingual environments. As Mackey (1971) has shown, there are many different ways of becoming bilingual and consequently many different types of bilingual. To speak of "bilingualism" leading to various cognitive advantages or disadvantages serves to obscure the ways in which the learning and use of two language systems can affect cognitive functioning. The learning of two languages will affect cognition in different ways depending on the age at which the languages are learnt, whether they are learnt separately or simultaneously, the opportunities for using both languages in the home, school and wider environment, the prestige of the two languages etc. Macnamara (1973) makes a similar point when he emphasizes the dangers of generalizing bilingual research results.

However, the results of this study showed that in some bilingual learning situations there are factors operative which appear to confer intellectual advantages on the bilingual. The most obvious educational implication of these results, and of other recent studies of the same topic, is that we may be depriving many children not only of the cultural, but also of the cognitive enrichment of becoming bilingual by not instituting more widespread bilingual education in the early grades of elementary school.

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APPENDIX A

INTELLIGENCE MEASURES

The three subtests of the Kuhlmann-Finch Intelligence Test which were administered to the bilingual and unilingual groups are shown on pages 97-104. Subtest 1 (verbal ability) is shown on page 98, subtest 2 (spatial ability is shown on pages 99-100 substest 4 (general reasoning) is shown on pages 101-104.

The following directions were given to the children before the test booklets were distributed:

> To-day we will have a short test. Clear your desk. You should have a pencil with an eraser. When you get a booklet fill the blanks on the first page then keep your booklet closed until I tell you what to do.

After the booklets were distributed the following directions were given:

> There are five parts to this booklet but we are only going to do three. Each part is different, so listen carefully while I read the directions to you. Some parts have only one page; some have more than one. When you come to the end of a page, always read what to do next. Sometimes you are directed to go on to the next page; sometimes you are directed to stop and wait. Try to answer every question as you go along. Even if you are uncertain, put down the answer you THINK is best. Now turn to page 3.

The directions for each of the three subtests were read out exactly as they are given in the Kuhlmann-Finch manual.

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LEAVES 98-104.

APPENDIX B

DIVERGENCE MEASURES

For both divergence measures the instructions were designed to create a game-like "fun" atmosphere. The instructions for the Patterns Test were read out as they appear on page 110. The following directions were read out for the Utility Test.

> This is called the "Utility Test" but its not really a test, it's more like a game. What you've got to do is write down all the different ways you can think of in which an object could be used. For example, if the object were "string" you could put down - to sew with, to attach a fish hook to, to hang clothes on, to tie someone up with etc. There are no wrong answers in this game. Write down any use that you can think of. Try to think of uses that no one else will think of. You will have 6 minutes for each part; don't go on to the second part until I tell you.

NAME ______________________________

UTILITY TEST

In this test you are to list as many uses as you can think of for a common object.

Write as rapidly as you can. Give all the uses you can think of. Your answers do not have to be complete sentences. You may use short phrases.

When the signal is given (not yet) turn the page, read the name of the object and example, then list all the uses of the object that you can think of.

There are two parts in this test. You will have 6 minutes for each part.

STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

Page 2

Part I (6 minutes)

List as many uses as you can think of for a brick.

Write each use on a separate line.

Example: build a house.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________
15. ____________________
16. ____________________
17. ____________________
18. ____________________
19. ____________________
20. ____________________

STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

Page 3

Part II (6 minutes)

List as many uses as you can think of for a wooden pencil.

Write each use on a separate line.

Example: write a letter.

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

9. ____________________

10. ____________________

11. ____________________

12. ____________________

13. ____________________

14. ____________________

15. ____________________

16. ____________________

17. ____________________

18. ____________________

19. ____________________

20. ____________________

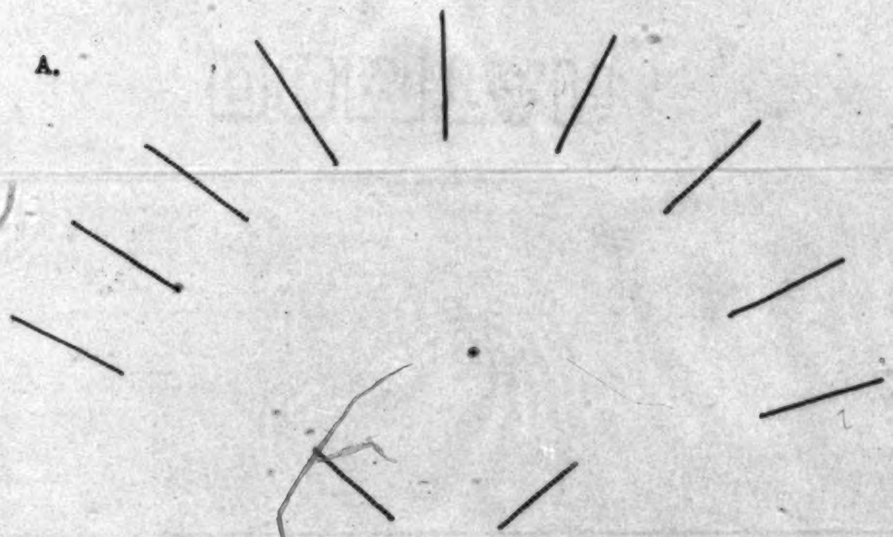
STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

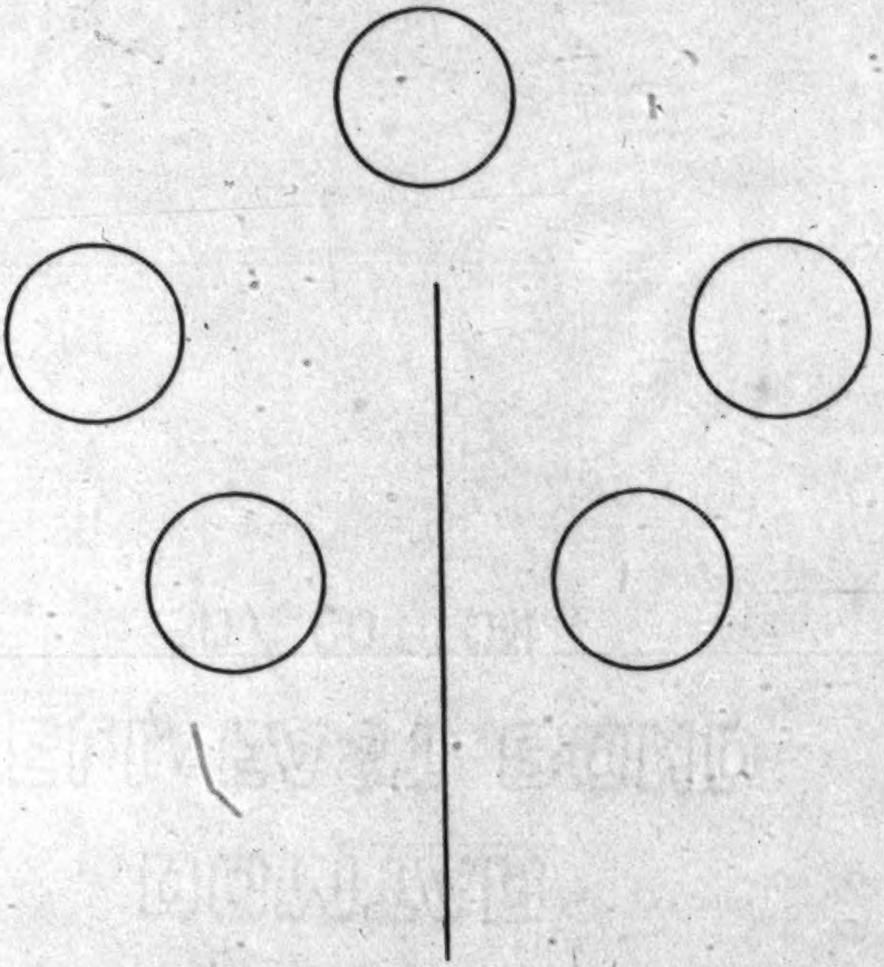
THE "WHAT IS IT?" GAME

Here is a game in which you can really feel free to use your imagination. On each of the pages in this booklet there are drawings. After looking at each drawing write down all the things which you think the complete drawing could be. You can turn the drawing around any way you would like to - sideways or upside down. For example, what could the drawing at the bottom of this page be? Some people think this looks like a rising sun, a porcupine, eyelashes, a brush, a carnation and probably lots of other things too. You have probably thought of some different things yourself.

Now remember, try to think of things that nobody else will think of and work by yourself. Work at your own pace. You will have twenty minutes for the eight patterns.

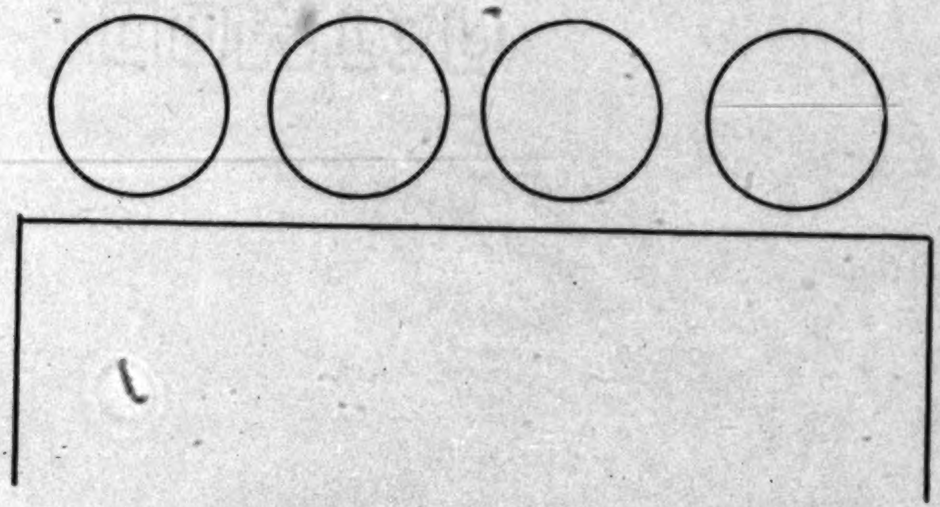
A.



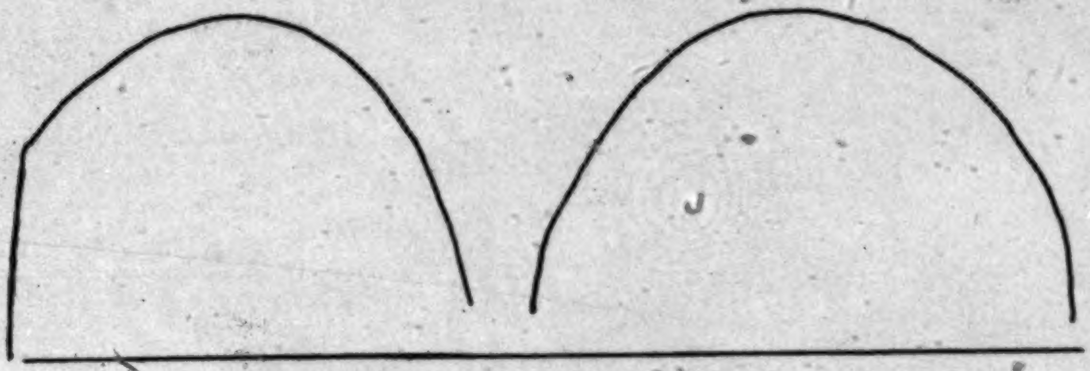


B. This pattern could be:

C. This pattern could be:

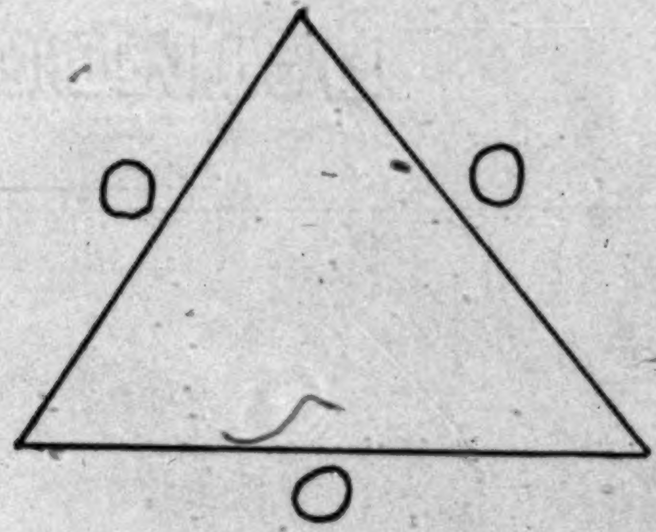


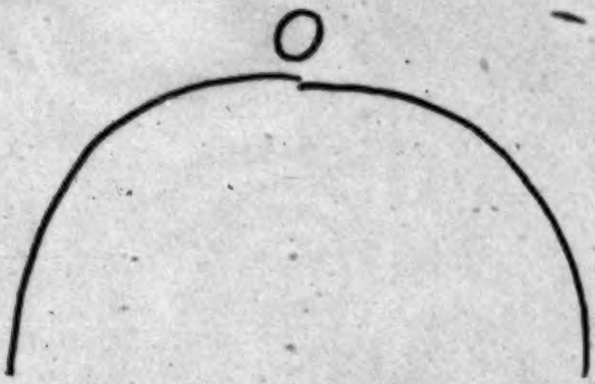
D. This pattern could be:



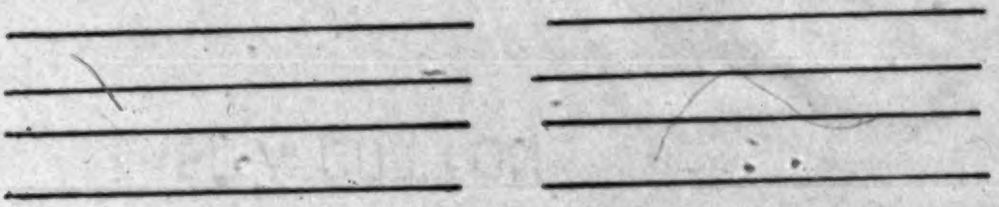
E. This pattern could be:

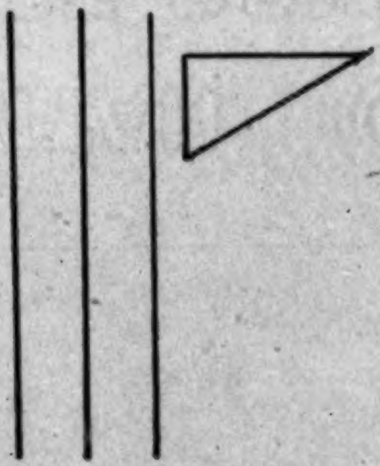
F.



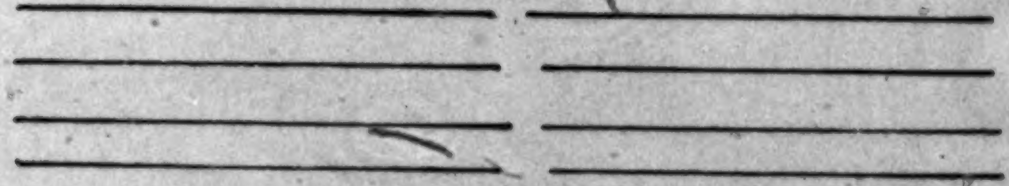


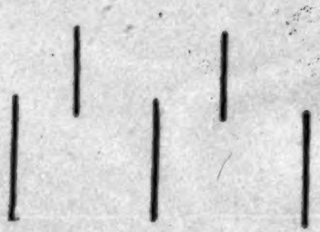
G.



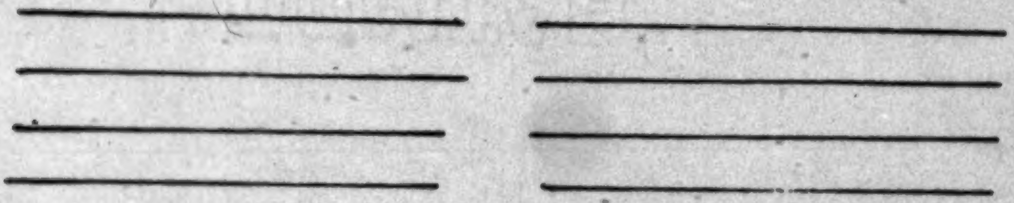


H.





I.



APPENDIX C

MEMORY TESTS

The following directions were given before the tests were projected on the screen (by means of an overhead projector):

> The tests we are going to do now are tests to see how well you can remember words. The words will be projected onto the screen for a short time. When the words are taken off the screen write down as many words as you can remember in the booklet provided. Please leave your pencils on the desk when you are learning the words.

The memory tests and the instructions for each test are shown as they were projected (pages 118-124). While the instructions for each test were being projected the experimenter read them out. After the instructions for each test were read out the children were asked if they understood what they had to do and the experimenter answered any questions that were asked.

MEMORY TEST NO. 1

In this test you will have to learn 16 words. The words will be projected on the screen for two minutes and read out once. In learning the words it might help you if you try to imagine the object in your head. For example, if one of the words was "chair", you could picture a "chair" in your head.

Leave your pencils on the desk while you are learning the words and when the time is up write down as many words as you can remember on the answer sheet. You can write down the words in any order.

MEMORY TEST NO. 1

TABLE
BOOK
STORM
BOTTLE
SHOE
PAPER
SHIP
ARROW

CLOCK
KING
DOG
STAR
VOLCANO
PENCIL
PRIEST
FISH

MEMORY TEST NO. 2

The idea in this test is the same as in the first test. You will have two minutes to learn 16 words. However, in this test some of the words are connected to each other in various ways. You might find it easier to learn the words if you looked for the connections between them, or the ways in which some of the words go together. Again, you must write down as many words as you can remember, but the order of the words doesn't matter.

MEMORY TEST NO. 2

MIND
SICKNESS
VISION
LENGTH
DISTANCE
HEALTH
SPIRIT
SMELL

YARD
THOUGHT
MEDICINE
SENSE
TREATMENT
TASTE
MILE
SOUL

MEMORY TESTS NOs. 3 and 4

The next two tests are different from the first two. In these tests you will be shown PAIRS of words and you must learn the two words together. For example:

book - cup

paper - street etc.

Here you would have to learn that book and cup go together and that paper and street go together etc.

You will have to learn 8 pairs of words. They will be projected on the screen and read out twice. When the projection is taken from the screen the first word in each pair will be read out and you will write down the second word on the answer sheet. For example, if the word "paper" is read out, you would write "street" and if the word "book" were read out, you would write "cup".

MEMORY TEST NO. 3

1. BRAIN - FLAG
2. MISSILE - ROCK
3. VILLAGE - SKULL
4. GARDEN - WINDOW
5. SKIN - PIANO
6. SNAKE - HOUSE
7. WOMAN - PEACH
8. ELBOW - HOTEL

MEMORY TEST NO. 4

1. LIFE - BRAVERY
2. TIME - HAPPINESS
3. COST - EVIDENCE
4. JUSTICE - AIR
5. SHOCK - TRUCE
6. LAW - ANSWER
7. PANIC - FREEDOM
8. MILEAGE - CRIME

APPENDIX D

LANGUAGE QUESTIONNAIRES GIVEN TO THE BILINGUAL AND UNILINGUAL GROUPS

Bilingual Group Language Questionniare

The questionnaire on page 127 was given to the three bilingual classes to determine whether French or English or both languages were spoken in the home, and also the child's own preference for French or English.

The following is a tabulation of the replies to each question.

Q.1: Three children were eliminated from the sample because they were trilingual i.e. they included a language other than French or English in their reply to Q. 1.

Q.2: 66 children replied they could speak English best; 10 replied they could speak French best and 6 replied "both" even though this was not included as an option.

Q.3: 23 replied "English", 29 "French" and 30 "Both French and English". The children were grouped into three home background groups on the basis of their replies to this question.

Q.4: 32 replied "English", 29 "French" and 21 "Both French and English". It is apparent from this that there were several homes where the parents spoke both languages but the child tended to speak only English. Most of the children whose parents spoke French at home also spoke French but there were a few who said they spoke both French and English at home.

Q.5: 64 replied "English", 18 replied "Both" and no students replied "French". The difficulties of maintaining French in an English-speaking city can be seen from this and other replies.

NAME: ______________________________

DATE OF BIRTH: ______________________

1. WHAT LANGUAGES CAN YOU SPEAK? ____________________

____

____

2. WHICH DO YOU SPEAK BEST? ____________________

3. WHAT LANGUAGES OR LANGUAGE DO YOUR PARENTS SPEAK AT HOME?

____

4. WHAT LANGUAGE DO YOU SPEAK AT HOME?

____

5. WHAT LANGUAGE DO YOU SPEAK WITH YOUR FRIENDS?

____

Unilingual Group Language Questionnaire

The questionnaire on page 129 was given to the three classes from which the unilingual sample was drawn.

The following directions were given. For Q.1 the students were told to answer "Yes" if they had any knowledge of a language other than English, which they had learnt outside of school. In one of the classes children had about one years' instruction in French. They were told not to count this and answer "No" unless they had some knowledge of another language that they had acquired outside of school. The students in the other two classes had received no second language instruction.

For Q.3 the students were instructed to check "Very Well" if they could carry on a conversation in the language with no difficulty whatsoever. They were told to check "Fairly Well" if they felt they could carry on a conversation in the language, but only with difficulty. They were told to check "Not Very Well" if they knew only a few words of the language and could not carry on a conversation.

54 students answered "No" to Q.1, 17 answered "Not Very Well" to Q.3 and 18 answered either "Fairly Well" or "Very Well". A one-way analysis of covariance with SES as covariate showed no significant differences between these three groups on any of the variables.

The 18 students who answered either "Very Well" or "Fairly Well" on Q.3 were excluded from consideration for the unilingual sample, and from the remainder a group of 61 was matched with the balanced bilingual group on the basis of sex, SES and age.

NAME: ____________________________

DATE OF BIRTH ________________________

1. CAN YOU SPEAK ANY LANGUAGE OTHER THAN ENGLISH?

YES NO

2. IF YES WHAT LANGUAGE CAN YOU SPEAK? ________________

3. HOW WELL CAN YOU SPEAK IT?

VERY WELL FAIRLY WELL NOT VERY WELL

APPENDIX E

BALANCE MEASURES

Word Association

The subjects were required in both the English (E) and French (F) Word Association (WA) tests to write down their associations to four words in each language. There was one word typed at the top of each page and subjects had one minute for each word. The E WA test was administered first, followed by the E and F self-rating and the F WA was administered last.

The E words were: street, dog, school, peace.

The F words were: paix, chien, rue, école.

The following instructions were written on the first page of the E WA booklet:

> Write down as many words as you can think of, in English, which "go with" or belong with the words on the following pages.
> Example
> Kitchen: food, table, fridge . . . etc.
> Please do not turn the page until you are told to start and put down your pen when you are told to stop. You will only have one minute for each word so write quickly!

The following instructions were writen on the first page of the F WA booklet:

> Ecrivez le plus de mots francais possible se rattachant a chacun des mots aux pages suivantes.
> Exemple
> Cuisine: repas, table, chaise . . . etc.
> S.V.P. ne tournez pas la page avant qu'on vous le direz et posez votre crayon sur votre pupitre lorsqu'on vous dira d'arrêter. Vous n'aurez seulment qu'une minute pour completer chaque mot, alors écrivez vite!

Subjective Self-Rating

The following instructions for completing the subjective self-rating form were read to the children:

> What I want you to write down is how well you understand, speak, read and write both English and French. For example, if you think you understand French "Fairly Well" put a check mark here, on top (indicating), and if you think you understand English "Very well" or "Very Fluently" put a check mark here, on the bottom (indicating). Any questions?

The self-rating form itself is shown below.

CHECK THE CATEGORY WHICH BEST DESCRIBES HOW YOU UNDERSTAND, SPEAK, READ AND WRITE BOTH ENGLISH AND FRENCH.

	Not at all	Some	Fairly Well	Very Fluently
Understand French				
Understand English				
Speak French				
Speak English				
Read French				
Read English				
Write French				
Write English				

Teacher Rating

The instructions given to the teachers for rating the relative competence of the children in English and French are shown below:

The purpose of this questionnaire is to find out how many students in your class you feel can benefit equally from instruction through French and through English.

I would be very grateful if, opposite the student's name on the class list, you would write the number which seems most appropriate to describe his capacity for learning in both languages. For example, if the student can benefit equally from instruction in both French and English write 3 opposite his name.

Thank you,
James Cummins.

1. Benefits much more from instruction through French.
2. Benefits somewhat more from instruction through French.
3. Benefits equally from instruction in both French and English.
4. Benefits somewhat more from instruction through English.
5. Benefits much more from instruction through English.